THE MODEL ENGINEER

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SOME INTERESTING OLD MODELS OF THE 19th CENTURY

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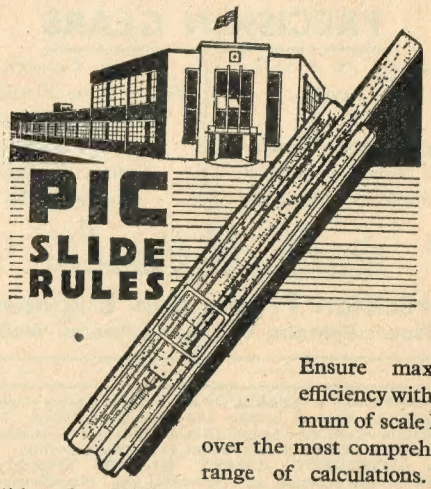

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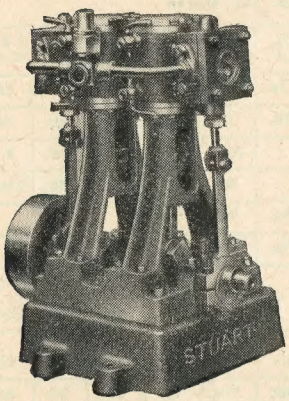

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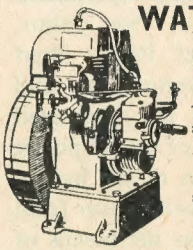

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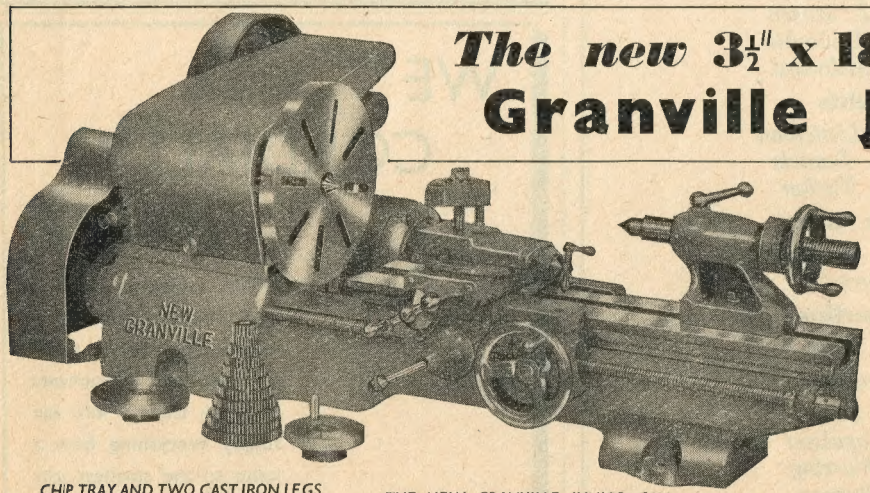

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EVERY THURSDAY

Volume 110 - No. 2767

JUNE 3rd 1954

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Our Cover Picture

Scope for the craft of the model-maker may be found in the most unexpected places, and many of our readers have produced interesting and excellent models of familiar objects of the countryside, including farm implements and vehicles. From the mechanical aspect, the traction or portable steam engine, the threshing machine, and the motor tractor, all have a strong appeal, but there is also a keen interest in traditional types of farm vehicles, the roots of evolution in which go back far beyond the dawn of the industrial era. Such models have a very definite value in preserving exact records of the types of vehicles used for centuries in various parts of the country.

Our photo shows an example of a typical Oxfordshire wagon, modelled to a scale of 1½ in. to the foot, by Mr. E. J. Perkins, of Aylesbury, who has accurately reproduced not only the characteristic contours of the woodwork of this picturesque vehicle, with correctly built, tyred and hub-bonded wheels, but also the details of the hand-forged iron fittings. This model was awarded a Highly Commended Diploma at the 1953 "M.E." Exhibition.

SMOKE RINGS

Transport of Models

WE OFTEN hear of difficulties in transporting bulky or fragile models, and the constructors of these often have good reason to hesitate before trusting them to the tender mercies of ordinary road and rail transport. Many excellent models, we feel sure, are prevented, because of this deterrent, from appearing at the "M.E." Exhibition, which is quite rightly regarded as representative of all that is best in model engineering throughout the country.

While it would not be practicable for us to take responsibility for the transport of models to the exhibition, we are always willing to do our best to help exhibitors who encounter special problems in this respect, and we may be able to suggest ways and means of ensuring their safe transit. Any readers who have models which they wish to enter for the "M.E." Exhibition, but are deterred from doing so by transport difficulties or risk of damage, should write as early as possible to the Exhibition Manager, Model Engineer Offices, 19-20, Noel Street, London, W.1.

The Salisbury Exhibition

THE EXHIBITION which will be open at the Market House, Salisbury, Wilts, on Saturday, June 5th and Monday, June 7th, will include a number of items of more than usual interest. Mr. R. A. Read, hon. secretary of the Salisbury and District M.E.S., states that the R.A.F. stand will show an 8-ft. span Vickers *Valiant* and a large model of a *Supermarine Swift*. In fact, the latter is the one used to play the part of *Prometheus* in the film "Sound Barrier." A number of smaller model aircraft, together with other kinds of models and some engineering test-pieces made by R.A.F. apprentices at Halton, will also be on view.

The Rev. G. S. Long, of Broadstone, will exhibit his 3½-in. gauge G.W.R. King class locomotive chassis. A "vintage" A.C. car will be there, as well as the 1909 Minerva 412-c.c. motor-cycle, which gained a second-class award in the London-Brighton run last March. These are only a few of the good things which are being collected together for the occasion. The Cheltenham and other societies in the Southern Federation are lending their support.

The Kodak Exhibition

AT THE Biennial Exhibition of the Kodak Society of Experimental Engineers and Craftsmen, held recently at the Kodak Hall, Wealdstone, the exhibits were noticeably fewer in number than they have been at some of the previous exhibitions of this society, but nevertheless included some excellent examples of craftsmanship in all sections, including several finished and unfinished locomotives of various types, two traction engines, power boats, sailing yachts and period ship models. We hope to be able to publish a more detailed description of the Exhibition, with photographs, in a later issue.

Why the Train Was Late !

ACCORDING TO a paragraph published recently in the daily Press, a traveller who had been inconvenienced by the unpunctuality of his train, telephoned British Railways to enquire the reason why. The official explanation was: "The 39 minutes' delay was caused by the engine failing to pull the train along at the desired speed."—"*But in what way did the engine fail?*"—"It was short of steam, as we say."—"*What causes that—bad coal?*"—"It could be a contributory factor."—"*Could it be that the engine is worn?*"—"That could also be contributory to the delay. There are many things that might have caused the loss of steam, which is a rarity—especially on a train going that distance."

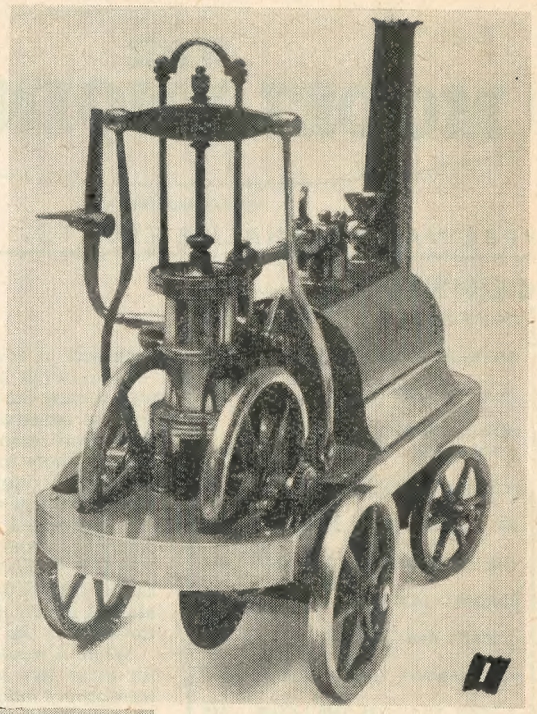
Our only comment on this conversation is that if it has been correctly reported, the owners of British Railways ought to do something about it !

Interesting Old Models

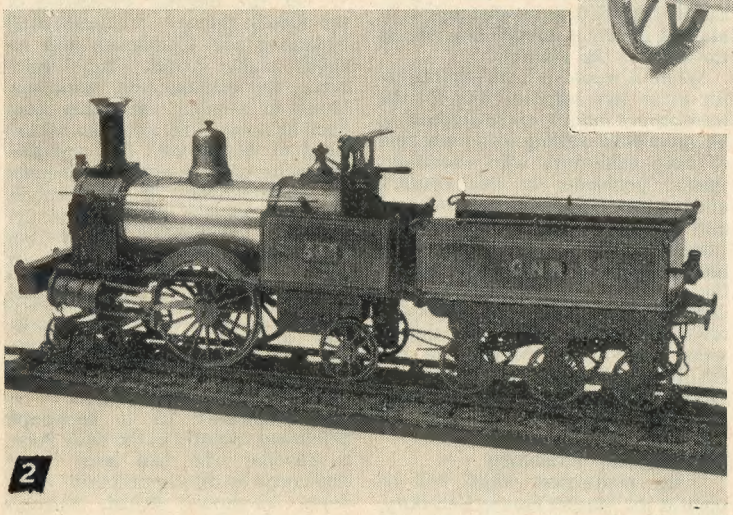
By "Northerner"

IN modern times, when things are made comparatively easy for our hobby—note that I said "comparatively"!—we are apt to forget our predecessors, who had no MODEL ENGINEER, no "approved advertisers," and very often no power (except their own muscles) to drive their lathes and drilling-machines, which frequently were of the simplest type.

In the circumstances, it is not surprising that adherents to the craft were few, and that not many examples of their work have come down to us. Perhaps we should exclude from that remark the work of professional model makers, but even of this a great amount has vanished.



(1): *Rear view of the 105-year old model loco, with sun-and-planet motion and gear drive. Note the cylinder standing on turned columns, and gear drive to rear axle*



An early "commercial" model locomotive, with spirit firing and slip-eccentric valve-gear

However, at the recent exhibition held in Leeds, there were three or four old-time models which have survived the years, and a description of these will serve to show that although great strides have been made in the past few decades, the old craftsmen undoubtedly were ingenious and painstaking.

Over a Century Old!

The first of the old models was a locomotive, exhibited by G. D. Lambert, which was built 105 years ago by an ancestor, G. Lambert, a linen merchant of Hull. It is particularly interesting, possessing "sun-and-planet" motion and a valve of the oscillating plug type.

The brass footplate is a casting, 16½-in. long and 5⅞ in. wide, with a deep flange all round for strength. It is ¼ in. thick on top, and ⅛ in. on the flange. The boiler is of copper, and is 6¼ in. long by 4⅛ in. in diameter.

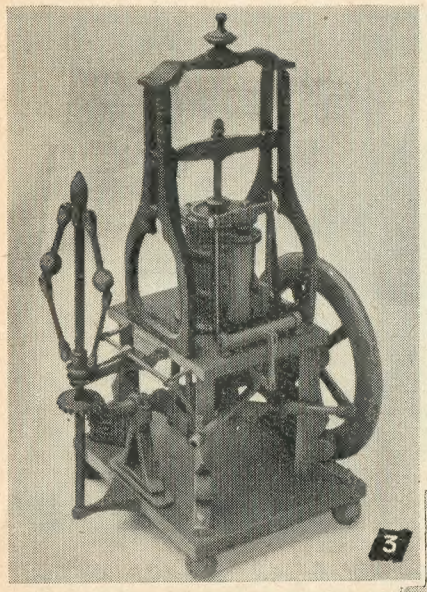
Situated beneath the boiler, the firebox is of sheet-iron, with a hinged door on the side; the bottom is largely drilled away with ½-in. holes, to provide plenty of air for burning the coke fuel. From the rear end of the firebox an oval brass flue bends upwards and then forwards to pass through the boiler to the front end.

There is no smokebox; the chimney merely has an oval tubular spigot which plugs tightly into the end of the flue-tube. The underside of the boiler is all heated surface, of course. Evidently only a low-steam pressure was used, for the flat boiler ends are unstayed (except for the flue-tube); the front (chimney) end is held in by screws.

The boiler fittings include a built-in brass funnel with cock, presumably for filling, a dead-weight safety-valve (weight now missing) and a dome from which a pipe runs direct to the plug-valve, with a cock interposed to act as a "regulator."

Motion Work

Cast in brass, the cylinder has a stroke of 2-in. with a bore of about 1½ in. It stands on four short turned brass columns, and the piston rod drives upwards a wide crosshead, which is also cast in brass, and is guided by two rods. The lower ends of these are screwed into the cylinder cover, and the upper ends are tied by a bridge piece.



(3): *A beautiful piece of craftsmanship of* 120 *years ago; a model table-engine built entirely in wood*

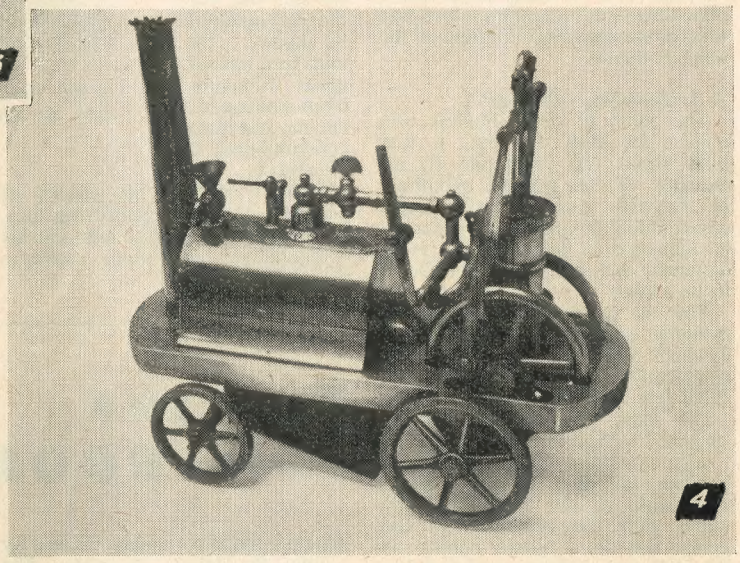
(4): *Side view of the* 105-*year old model loco shown in photograph* 1

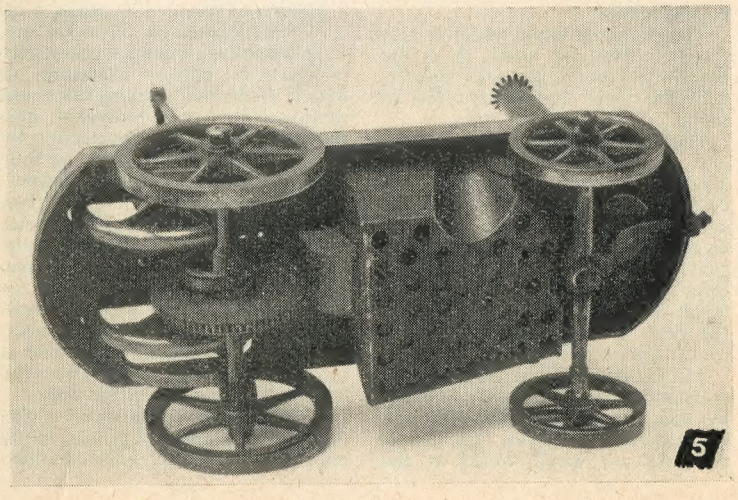
(5): *Underside view, to show gear-drive, eccentric, firebox, and pivoted front axle*

with split bearings. At the front the axle swivels on a cast brass bracket, and has a pointer attached to indicate the degree of angularity on what would be the front buffer-beam, if the engine had buffers ! The pointer can be locked in position by means of a screw passing through it to bear on the " beam."

Another " Ancient Lights "

There was another locomotive at the exhibition which was a mere 60 or 70 years old—a 4-2-2 engine now owned by Frank Cook. This was a " commercial job," but the name of the builders is not now known. The engine was rescued from a cellar where it had stood for more than 38 years; it was covered in whitewash and filth,





From the ends of the cross-head, two shapely wrought-iron connecting-rods return the motion to the double sun-and-planet gear which drives the flywheel shaft—we can't call it a crankshaft ! This is mounted in two split bearings on the bedplate, and carries two brass flywheels 5 in. in diameter.

A pinion on this shaft meshes with a spur-wheel on the driving-axle, with a 1 to 2 reduction. However, the driving-wheels rotate only once for each complete stroke of the engine, because the sun-and-planet gear drives the flywheel shaft at twice the speed that a crankshaft would revolve. To a tyro, strange, perhaps, but true, in spite of the " sun " and the " planet " having the same number of teeth !

As already mentioned, the valve is of the oscillating type; it is worked by an attached lever which is slotted. An eccentric is mounted on the driving axle, with the eccentric-rod attached to the valve-lever; the point of attachment may be altered in the slot, so varying the degree of oscillation of the valve. The exhaust passes from the end of the valve, and is led to the flue-tube.

A separate pipe with a cock is attached to the steam-pipe; this may have served as a lubricator, or may have been added to allow the model to be run under compressed air.

The wheels are of cast-iron, $4\frac{5}{8}$ in. diameter at the back and $3\frac{1}{2}$ in. at the front, and the driving axle is carried in cast-brass brackets

and Mr. Cook had quite a job to clean her up and make her respectable again.

The frame of the engine is a flat brass casting, and the boiler is of brass with a single large oval flue passing through. Firing is by methylated spirits. The bogie is also a brass casting, and it is supported by a downward extension of the smokebox.

Brass is also used for the cylinders, with two round slidebars and brass crossheads. The valves are driven by slip-eccentric gear, and it should be mentioned that the engine will still run quite well.

Other brass castings include the chimney, dome, splashers, wheels, number-plates, and name-plates. The backhead carries a regulator quadrant and lever—the former marked ON and OFF—a water-gauge and a blow-down cock; a safety-valve and whistle are mounted in front of the weather-board.

A Table-engine—In Wood!

The third of these models was even older than the first; it was built about 120 years ago by an ancestor of the present exhibitor, H. Donald, and was of *wooden* construction throughout. The material appeared to be beech, but is so darkened with age that it is difficult to be certain.

This is quite a dainty model, standing only 8⅛ in. high, with a flywheel of 3½ in. diameter. It is completely working, including the valve-gear and governor-gear.

On close examination I was surprised to find that the crankshaft —with two cranks, don't forget!— had been turned *in one piece*. When one thinks of the thinness of the webs, with the shortness of the grain, this is a great tribute to the skill and delicate workmanship of the builder.

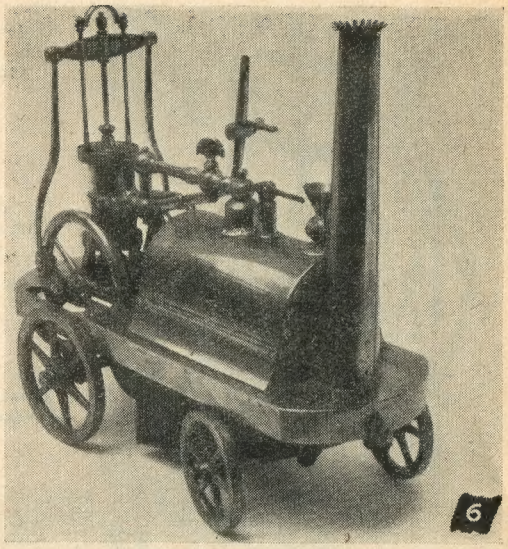
The governor bevel-wheel is also "solid" with the shaft, as is the bevel-wheel on the governor spindle, with the teeth apparently filed to shape.

The flywheel is carved in one piece, and the crankshaft runs in split bearings; strap-type bearings are fitted at the lower ends of the connecting-rods. To enable it to fit over the shaft, the eccentric was split; it drives the valve rocker shaft through a rocker-arm under the table, and also the feed pump at the back of the engine through a rocker-arm and links.

All the parts of the framing and entablature are fastened together by pegs which are carved on the components themselves. The governor-links are wood-pinned at the joints, too, but the action is quite flexible.

This little engine is indeed a beautiful piece of craftsmanship, the material may not be suitable to the subject, but the builder had no knowledge of metalwork, no facilities for doing it, and no means of attaining such facilities.

Still, he wanted a model table-engine, and he set about it in the only way and the only material he knew. He must have gained great pleasure from making his engine, and from contemplating it afterwards. Let us admire him for his tenacity of purpose, and in remembering him, let us strive to emulate him and his companions, in their achievements!



In this view, note the pointer attached to the front axle, the screws securing boiler-front, and the boiler fittings

So, perhaps, in another century, some scribe yet unborn may be praising *our* work in THE MODEL ENGINEER—and isn't that a nice thought?

For the BOOKSHELF

Britain's Railways Today. Edited by John St. John. (London: The Naldrett Press). 192 pages, 6 in. by 9 in. Illustrated. Price 15s. net.

This book is somewhat out-of-the-ordinary in railway literature, in that it is divided into sections and each section is sub-divided into chapters. After an Introduction by Mr. D. S. M. Barrie, there are four chapters under "Motive Power," two under "Permanent Way," two under "Traffic Working," four under "Transport of Passengers and Goods" and two under "Engine Building and Research." Each of these chapters is the work of a railwayman specialist in the subject, yet careful editing has produced a satisfying continuity of style from the beginning to the end of the book.

A number of explanatory drawings and diagrams are printed in the text, but numerous halftone illustrations are reproduced on art-paper inserts, and nearly all of them are from modern official photographs.

The book is well written throughout, and we can detect only one actual error; it occurs on page 38, where the design of the Great Eastern Railway 4-4-0 *Claud Hamilton*, built in 1900, is attributed to S. D. Holden instead of to his father, James Holden.

The authors of the various chapters have wisely refrained from expressing opinions and are content to state plain facts, and in good, simple language. There is a pleasing interpolation of the human element where, in describing the work of such people as the stationmaster, the engine-driver, the signalman, and others, the name of a particular individual is given.

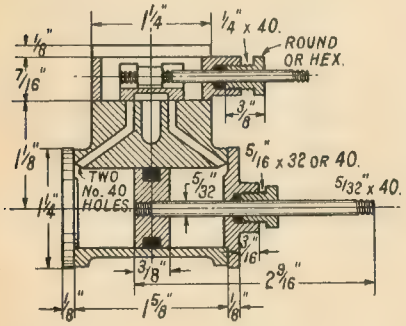
This is a good book which we can confidently recommend.

L.B.S.C.'s "Netta"

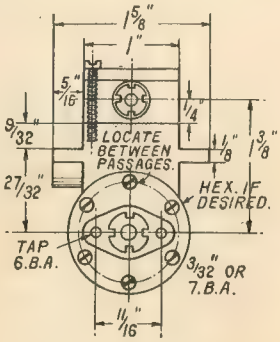
A NORTH-EASTERN T-CLASS "MITEY" HAULER IN FIVE GAUGES

THE cylinders for the 2½-in. gauge quin are $\frac{13}{16}$ in. bore and 1⅛ in. stroke. Except for slight differences in detail, they are pretty much the same as those previously described; so if I just refer to the variations, there won't be any need to go over all the rigmarole again. If a four-jaw chuck big enough to accommodate the cylinder is available, the procedure for boring and facing may be the same as described for the smaller cylinders. If not, attach an angleplate to the faceplate, set the casting on it with the portface down, and secure it with a bar across the back, held down by a bolt at each end. Adjust the casting so that the bore will be parallel to lathe centre-line, and the corehole running as true as possible; then face the flange at the end (the casting should overhang sufficiently to allow for this), turn the edge to about 1/32 in. less diameter than shown for the covers, and bore out the corehole until the lead end of a $\frac{13}{16}$-in. parallel reamer will just enter. If there is enough room between casting and faceplate, to allow the reamer to go well through, ream by aid of the tailstock as described in the last instalment. If not, the reaming will have to be done by hand, with the casting in the bench vice. If no reamer is available, bore to finished size without shifting the cross-slide on the last two traverses. Machine the flange at the opposite end with the casting on a stub mandrel, as usual.

The covers are machined, ports cut, passages drilled, pistons and rods fitted, and steamchest machined, by the methods I have now described so many times that regular followers of these notes should be able to do the jobs upside down and backwards. I mentioned that I didn't fancy this particular design of cylinder, in the previous note, because the portface and the bores are such a jolly long way apart, necessitating long passageways; therefore, I have cut the area of the passageways to the minimum which will enable enough steam to pass when running fast with normal load. To stop any "Mr. Wiseman" raising a moan about this, before he starts (says Pat) I might mention that the sizes of drill-holes shown, are the outcome of actual experiment. Superheated steam is very "fluid," and the small amount needed to keep the locomotive stepping lively, will not be retarded either in or out of the bore. Good folk with the average amount of gumption, as our readers naturally are, won't need telling that the extra steam needed for slow pulling with a heavy load, or the extra steam required to start, will have more time to pass through the holes, so we are O.K. all ways. When running, the steam remaining in the passages after the valve closes the port, will expand to the same degree as what is left in the cylinder, so it won't all be wasted; the exhaust pressure will only be a fraction of what it would be, with passageways as large as the cross-section of the port.



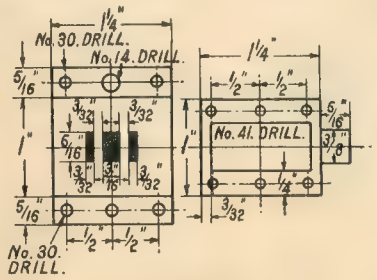
Section of cylinder—2½-in. gauge engine



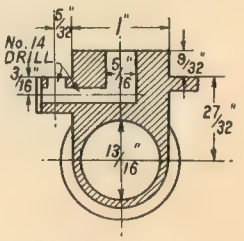
Back end of cylinder—2½-in. gauge engine

Variation in Slide-valves

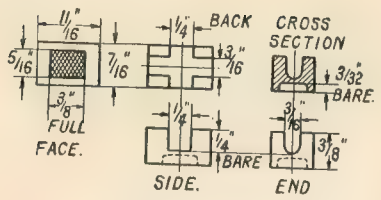
In place of the flat-and-slot drive of the smaller slide-valves, the 2½ in. gauge quin has valves driven by a rectangular nut on the valve spindle. Details and sizes are shown in the illustrations. The valve may be cast, or cut from a bit of bronze or gunmetal rod of suitable section. The cavity can be end-milled with a dental burr or small home-made slot drill, if a vertical slide is available. The ¼-in. slot for the nut, can either be endmilled with a ¼-in. mill or slot drill in the three-jaw, the valve being held on its side under the slide-rest tool-holder,



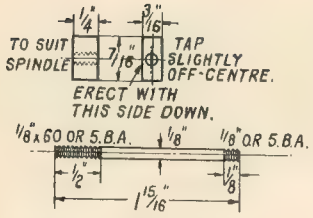
Portface and steamchest—2½-in. gauge engine



Section through exhaust port—2½-in. gauge engine



Slide-valve—2½-in. gauge engine



Valve spindle and nut—2½-in. gauge engine

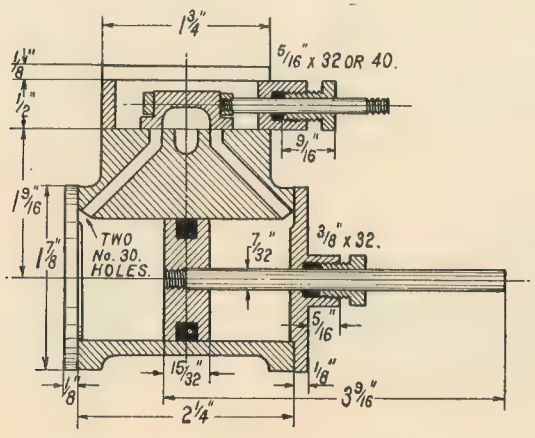
or else milled in the ordinary way, with the valve held in a machine-vice on the cross-slide or saddle, and the slot cut by traversing under a ¼ in. side-and-face cutter on a spindle either held in chuck, or mounted on an arbor between centres.

Although the drawing shows the slot for the valve spindle rounded at the bottom, this isn't essential, and the spindle will work in a rectangular slot, cut as above, as it would in the kind shown. However, the rounded bottom presents a simple way of forming the slot, which requires no milling. Just drill a $\frac{3}{16}$-in. hole lengthwise through the valve, just above the exhaust cavity, and saw down to it from the top of the valve, finishing to size with a file. This will produce the round-bottomed groove shown. When assembling, put the longer screwed end of the valve-spindle through the steamchest gland, holding the nut inside the steamchest, and screw the spindle into it. Put the valve on the portface, the right way around, and drop the steamchest over it, with the nut entering the wider slot in the back of the valve. Assemble the rest of the cylinder as given for the smaller sizes. The valve should not be held down tightly by the spindle and nut, but should have a wee amount of lift, which is the reason for drilling and tapping the nut a little off-centre.

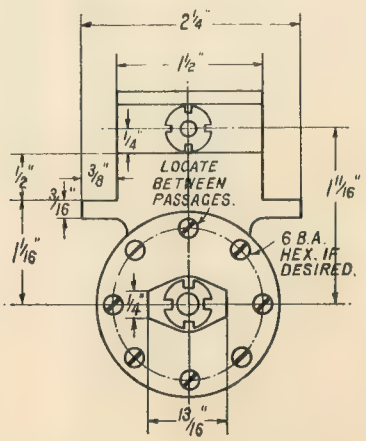
Cylinders for 3½-in. Gauge Engine

The cylinders for the "next size larger," differ a little more still, inasmuch as a buckle-driven valve is used, same as full-size practice. Also, the exhaust is arranged differently. The steam-chest has to project well through the frames, to enable the valve spindles to clear the leading hornblocks. This allows the portface to stand well clear of the frame; the vertical hole connecting the exhaust port cavity with the exhaust pipe, can be drilled inside the frame, direct into the port. The ends of the breeches-type exhaust pipe will be provided with flanges, to fit over the holes. Instead of the gland-bosses on the back cylinder covers being drilled and tapped for guide-bar spigots, they are squared off at top and bottom, the guide bars being attached to the seatings by separate screws.

The cylinders are 1¼ in. bore and 1⅝ in. stroke, the correct equivalent of the 20 in. × 26 in. of the full-sized locomotive. The castings are machined as described above for the smaller one, being mounted on an angleplate attached to faceplate, for boring, and turning the flange at one end, the other end being done with the cylinder on a stub mandrel. The portface is machined with the cylinder up-ended on the angle-plate, secured with a bolt through the bore, a big washer being placed under the nut. I usually make a thick washer of soft metal, as big as the cylinder flange, for this kind of job; the hole through it is only large enough to take the bolt. Between this washer and the nut, an ordinary steel washer is interposed, to spread the grip of the nut well over the soft washer, and prevent distortion and possible damage. Set the casting so that the centre of the portface coincides as near as possible with the lathe centres, and face with a roundnose tool set crosswise in the rest. Beginners please note, never neglect to bolt a weight of some sort, on the faceplate, opposite to the angle-plate, to balance same. Vibration of the lathe, doesn't only tend to produce a miniature earthquake in the workshop, but you can't produce true work unless the machine is perfectly steady. I know of a certain misguided party who bolted his lathe to a concrete floor, and boasted that he could do any job without bothering to rig up balance-weights. There wouldn't be any vibration. He soon found his mistake; the floor didn't rock, but the machine did ! He was amazed

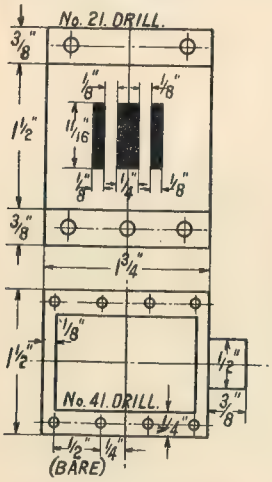


Section of cylinder—3½-in. gauge engine



Back end of cylinder—3½-in. gauge engine

to find out how much spring and "give" that there can be, in a seemingly rigid lathe bed and standards; the bolts set in the concrete worked loose. However, that wasn't so bad as a case that I happened across in the Kaiser's war; a munition contractor with more business ability than mechanical knowledge, took over a disused skating rink as a temporary "works."



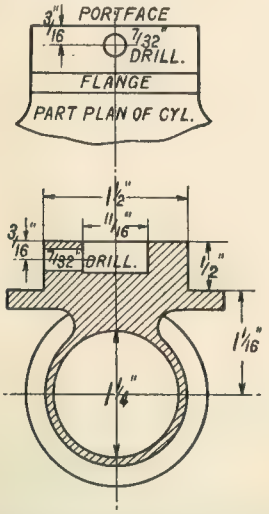
Portface and steamchest—3½-in. gauge engine

No electric power being available, he purchased a horizontal gas engine with a cylinder about 8 in. × 12 in. plus a 5 ft. flywheel, and screwed it down to the wood-block floor of the rink (it was for roller-skating, not ice) *with four big coach screws.* What happended when the engine was started up, can better be imagined than described !

The steam and exhaust ports should be endmilled, in the way I have described for other locomotives in these notes. It doesn't matter a bean about the ends being left rounded. Maybe one or two of our approved advertisers may cast in the ports, and even the passageways, which isn't very difficult on this type of cylinder; this would save work, and the port openings would only need truing up, either by hand or machine. If the ports are milled, don't make them more than ¼ in. deep at the most. After machining off the cylinder bolting flanges, and the "ledges" above and below the portface, mark off a point on the ledge, exactly in the middle of its length, and $\frac{3}{16}$ in. from the edge. Centrepop deeply, and drill a 7/32-in. hole straight down into the exhaust port. File off any burring. The position of this hole can be seen in the cross-section of the cylinder through the exhaust port, and the part plan.

Other Variations

The front cylinder covers are machined and fitted in the same way as the smaller sizes; but instead of the bosses of the back ones being drilled and tapped for guide bars, they are squared off top and bottom, as shown in the end view. The way I do this on my milling machine, is to slew the vice around until the jaws are parallel with the arbor; the machine vice, which is nearly always on the table, is of the swivel-base type. The machined cylinder casting, with back cover temporarily attached, is gripped in the vice with the portface against one of

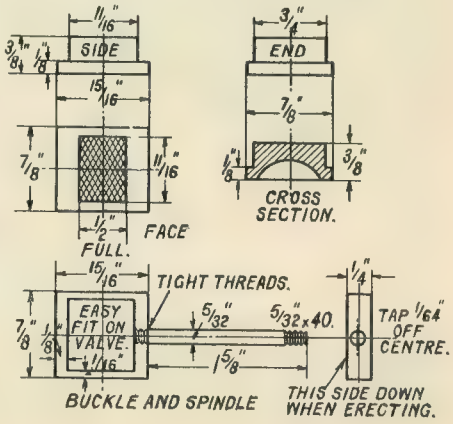


Location of exhaust hole, and section through exhaust port—3½-in. gauge engine

the jaws, cover on top. It is then run under a side-and-face cutter on the arbor, which cuts off the end of the gland boss to the previously-marked line, in less time than it takes to write these words. The cross-feed is then operated until the other end of the boss is at the right spot for the cutter to do the needful; a couple of turns of the handle on the table screw, and we're through.

This process can be emulated in the lathe, if a vertical-slide is available, using the same cutter illustrated in the last instalment, for milling the bolting flanges. Bolt the machine-vice to the vertical slide, so that the jaws are horizontal. Temporarily attach cover to cylinder, and grip in vice, cover outwards, with the portface horizontal, against one of the jaws. The two lines should be carefully marked off, naturally; when I'm marking off lines equidistant from a centre, as in the present case, I always put a dummy plug in the hole, with a centrepop in it at the true centre, and strike an arc each side with dividers. The straight lines are then marked off to touch the arc, which ensures that they are exactly the same distance each side of centre. Feed the saddle or top-slide toward the headstock, until the end of the cutter almost touches the cover at the side of the boss. Feed into cut with the cross-slide, and work the vertical-slide up and down until the side teeth of the cutter have cut down to the marked line. Then raise the slide so that the cover will run past the cutter; lower it again on the opposite side of the cutter, and ditto repeato cutting operation. The actual job is done quicker than giving the instructions. Another way would be to bolt the cylinder, with cover attached, to the saddle, cover on top, and run it under a side-and-face cutter on an arbor between centres. If there is enough room under the arbor. the cylinder could be held in a machine-vice, regular or improvised. Very often it happens that a couple of bits of angle, and two small bolts to hold them at the ends, will allow a job to be held on the saddle for a milling operation, when a regular machine-vice would not hold the job low enough to pass under the cutter.

If a vertical-slide isn't available, the flats could be hand-finished. Whilst the cover is chucked, boss outwards, for drilling and tapping



Slide-valve, etc.—3½-in. gauge engine

for the gland, face it off until the two ends of the gland boss are $\frac{7}{8}$ in. across. Remove from chuck, and carefully file the curved ends of the gland boss until they are flat, and $\frac{13}{16}$ in. apart.

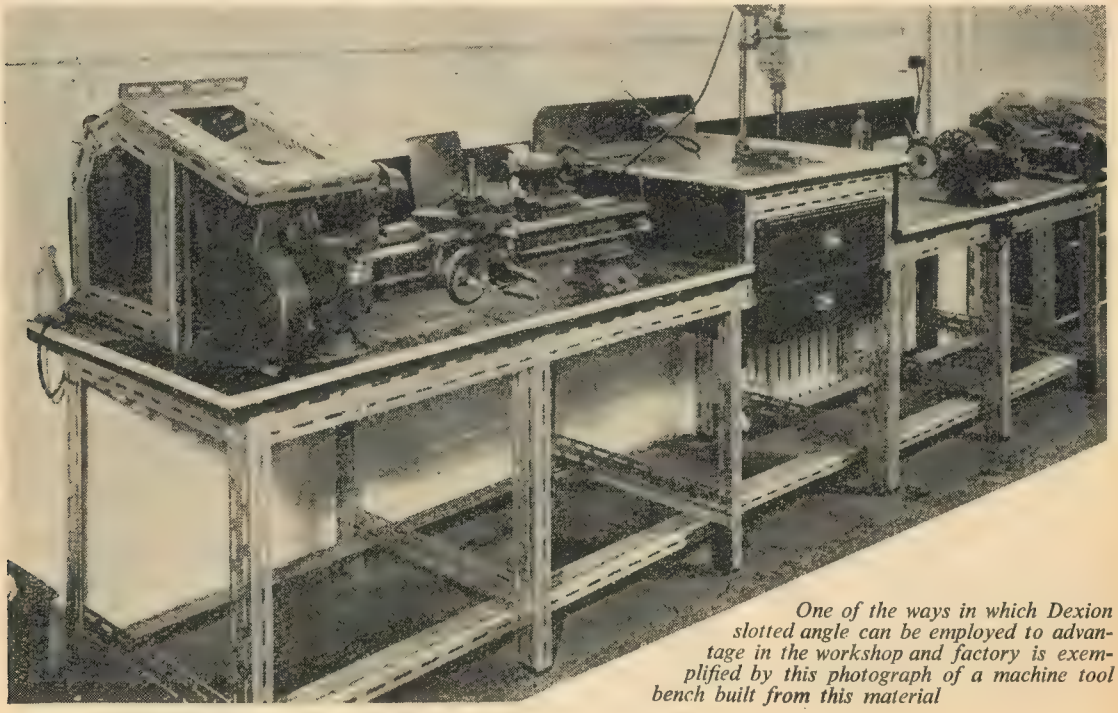
If our advertisers supply castings for the slide-valves and buckles, all that they will need should be a clean-up with a file. The buckle should fit the back of the valve easily, but without shake. If the valves are cut from bar, the rebates can be milled exactly as I have described goodness knows how many times, for axle-box milling. The buckles can be cut from $\frac{1}{4}$-in. × $\frac{7}{8}$-in. bar, brass or gunmetal; simply mark off, drill a hole about $\frac{5}{8}$ in. diameter in the middle of the rectangular space, and file to shape and size. The spindles are made from 5/32-in. rustless steel or phosphor-bronze; German silver would also do. They should be a tight screwed fit into the side of the buckle, so that there is no chance of slacking when in service. If there is the least sign of slackness after assembly, drill a 55 hole in the thickness of the buckle, letting the drill penetrate halfway through the spindle; tap it 10-B.A. screw in a stub of wire, and file flush. That will teach it good manners ! Assemble as shown, with thick oiled paper, or 1/64 in. Hallite or similar jointing, between all contact joints. Next item, cylinders for the biggest quin.

Dexion Slotted Angle

A VERY interesting and practical demonstration of the applications and methods of using Dexion slotted angle constructional material was given in London recently. Many of our readers are already familiar with this material, which has been on the market for several years, but a new and improved form, known as Dexion 225, has now been introduced, and is available in both steel and high-tensile light alloy. The particular feature of the new material is the ingenious arrangement of holes and slots, which facilitates its use, and also gives scope for many applications where ordinary slotted or pierced angles, or other sections of metal, cannot be used.

The speed and facility with which frames and structures for almost any purpose in both civil and mechanical engineering can be erected, indicates that it has a great future in many industries, and this impression is supported by the fact that in addition to a rapidly rising output in this country, new factories for its production have been started in Canada and the U.S.A. A remarkable example of its application occurred in connection with the re-housing of victims of the 1953 earthquake disaster in the Ionian Islands, where 20,000 ft. of Dexion angle were used in the construction of frames for prefabricated buildings.

Apart from its uses in industry, the amateur will find the solution to many structural problems in Dexion slotted angle, as it can be used to build benches, trestles for portable track, machine tool stands, etc. As the framing for a small workshop, Dexion angle would probably be much stronger and more durable than most of the materials usually employed, also less expensive in the long run. The steel angle is surface treated and enamelled to prevent corrosion, and the light alloy is also resistant to corrosion and chemical action. This material is manufactured by Dexion Ltd., 189, Regent Street, London, W.1.



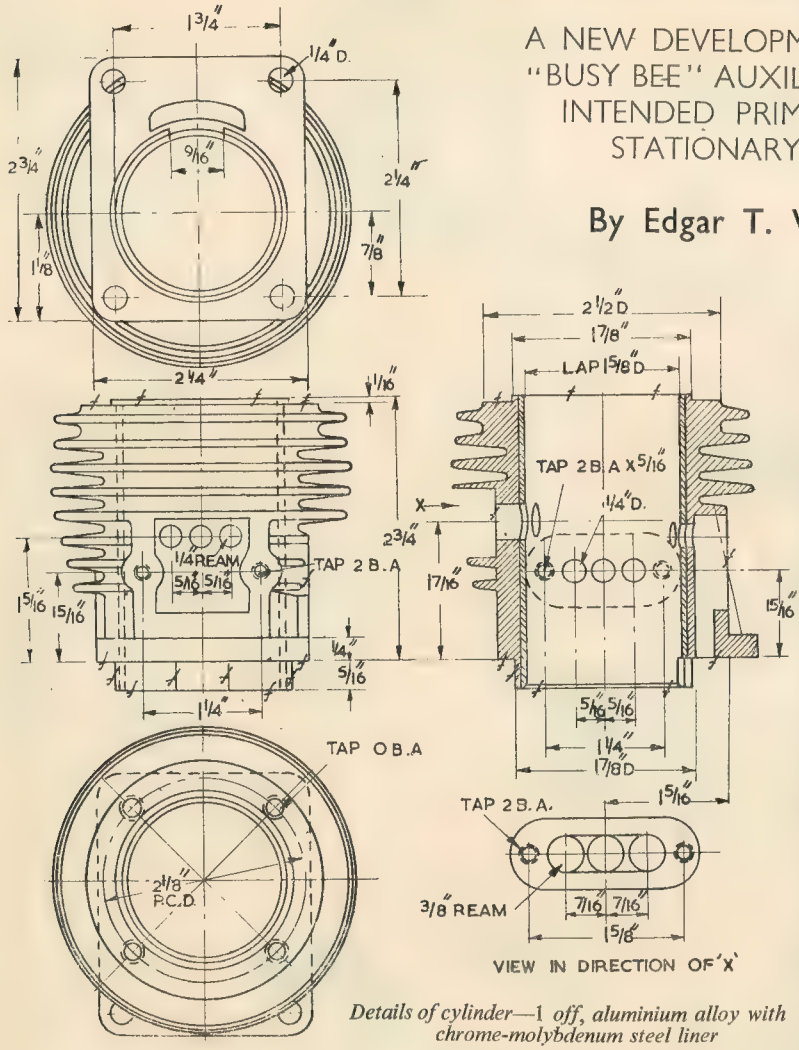
One of the ways in which Dexion slotted angle can be employed to advantage in the workshop and factory is exemplified by this photograph of a machine tool bench built from this material

THIS PARTING-OFF PROBLEM
By B. Terry Gaspin
THE NONCHALANT BACK-TOOLPOSTER
THE CHATTER FIEND
AN INADVERTENT DIG-IN
THE HERO
THE COWARD

The 50 c.c. "BUMBLE BEE"

A NEW DEVELOPMENT OF THE "BUSY BEE" AUXILIARY ENGINE INTENDED PRIMARILY FOR STATIONARY WORK

By Edgar T. Westbury



Details of cylinder—1 off, aluminium alloy with chrome-molybdenum steel liner

MANY of the machining operations on this engine are identical with those which have been fully described for the "Busy Bee" engine, and it should not, therefore, be necessary to describe them in detail. There are, however, some parts which have been modified in detail to improve them or simplify machining, while remaining functionally the same. This applies in particular to the cylinder, which so far as essential fitting dimensions, porting, etc., are concerned, remains the same as for the "Busy Bee," and is in fact interchangeable for either engine. But instead of the cast-iron cylinder originally specified, a light alloy gravity die casting with a high-tensile steel liner is now employed.

There are several reasons for this modification, the most important being to improve the cooling by providing a greater projected surface area, in a metal of higher conductivity. From the constructor's point of view, the simplified machining is also an important advantage, as the work necessary on an iron casting is somewhat on the heavy side for a light lathe, and must be carried out relatively slowly. The immediate alternative of using a light alloy cylinder with a pressed or shrunk-in liner, machined inside and out, actually increases the quantity of machining required, and there is always some risk of imperfect heat conduction between the liner and the outer cylinder wall. But in the form of cylinder now available, both these disadvantages are eliminated by the use of a cast-in semi-finished liner, the bore of which is within two or three thousandths of an inch of finished size, and can be finished by lapping or honing.

The only surfaces requiring actual machining, therefore, are the top and bottom faces, the latter, of course, including the spigot which locates the cylinder in the crankcase seating, and the end of the cylinder bore should be faced and bevelled out at the same setting. These operations can be carried out by holding the casting in the four-jaw chuck, setting it as true as possible from the bore, checked at both ends to ensure axial alignment. A more positive method of ensuring accuracy in this respect would be to mount it by the bore on a true mandrel, but few amateurs, I imagine, will possess a mandrel as large as $1\frac{5}{8}$ in. diameter, and even the material to make one would be hard to come by in many cases.

The lapping process for finishing the bore is the same as that which has been described for the "Busy Bee" and other engines, but in

Continued from page 550, *May* 20, 1954.

this case it is most important to use a lap which is capable of *generating* an accurate bore, as distinct from one which is spring-loaded, or otherwise automatically adaptable to inequalities in the surface. This is because in the case of the cast-in liner, the shrinkage of the light alloy on cooling exerts tremendous pressure on the liner, not necessarily equal at all points, and this may cause some local distortion, which must be eliminated in the finishing process. It may be mentioned that one of the most difficult problems in the design of the dies for casting the cylinder was that of avoiding excessive distortion, and also risk of cracking the outer wall through contraction stresses.

The type of lap which I have always recommended, mounted on a taper mandrel so that it can be expanded to accommodate it to the bore, fulfils the above conditions, but instead of splitting it right through in one place, and partially through in one or two others, it will be found that a number of saw-cuts made from alternate ends, for about three-quarters of the length, will improve flexibility and range of expansion. A cast-iron lap gives excellent control of accuracy, but does not work so fast as a copper or aluminium lap. I find it most convenient to carry out this particular process with the lap running in the lathe and the cylinder held in the hand, so that the action of the lap at all points in the bore surface can be felt. The lap should not be too long, or local control may be more difficult, and bell-mouthing of the bore more liable to occur. Some workers run the cylinder in the lathe and hold the lap mandrel in the tailstock chuck, but apart from the lack of sensitive control, this method may tend to produce scoring of the bore, as it is difficult to keep the lap moving endwise all the time.

Facing the cylinder base flange

Crankcase set up in four-jaw chuck for boring, and facing on one side

The ports should be drilled before the lapping is finally completed, as slight burring and distortion in the region of the holes may take place. Marking out should be done as recommended for the " Busy Bee " engine, using a scribing block on a surface-plate or other flat surface, and some form of height gauge such as a rule held in a suitable stand. All measurements should be taken from the underside of the cylinder base flange. The machining of port joint faces can be carried out by milling in the lathe or any other convenient method.

In common with the " Busy Bee " and several other engines of my design, circular ports are employed, as these can be produced by drilling, and are also easy on the piston rings, which cannot become trapped in them, and thus do not need to be pegged to prevent rotation. Some constructors of the above engine have squared out the ports to obtain greater port area, but the improvement in performance thus obtained, at the speeds for which the engine is designed to run, is hardly perceptible, and large port areas may impair flexibility, and the low-speed power characteristic which is one of the most useful features of the humble two-stroke.

The ports may be started with a pilot drill, well undersize, so that if the drill tends to wander, as it usually does, the port location can be corrected by means of a round file before opening it up further. One advantage of this form of design is that all ports are accessible for inspection when checking the port timing, and what is just as important, for decarbonising when the engine is overhauled. Some further details regarding port timing will be given when dealing with assembly.

It has already been explained that the crankcase design has been

dictated by the need to make the engine adaptable for working in various positions; true, the same result could be achieved by omitting the cast feet on the endplates and substituting separate cradle plates, but I have several reasons for avoiding these where possible. The form of crankcase shown is very simple to machine, and extremely rigid from the structural aspect, moreover it makes provision for efficient crankcase cooling without complicating casting problems.

It may be asked why crankcase cooling should be necessary at all; the answer is that it is not *necessary* but very desirable. In small engines, especially where there is an extensive use of high-conductive metals such as aluminium, heat transmission is so rapid that there is not a great deal of temperature difference between the cylinder head and the most remote point on the crankcase. Under such conditions, proper lubrication of the main working parts may be rendered more difficult, but an even more serious disadvantage is that the pumping efficiency of the crankcase may be reduced (at its best, it is never as high as one could wish !) by rarefication of the air passing through it. Those readers who have had experience with steam plants know how difficult it is to pump hot feed water; and to some extent, the same problems arise with air or air-fuel mixture.

Several years ago, I made experiments with the cooling of two-strokes which indicated that crankcase temperature had a direct effect on the power output which could be maintained continuously; and shortly after the war, Mr. J. Cruickshank, working independently, tried out a water-cooled crankcase on a 6 c.c. "Atom Minor" engine which definitely improved its performance. In many types of engines, the crankcase can be exposed to air currents which keep it reasonably cool, but where this condition cannot be guaranteed, there is much to be said for providing as much cooling surface on the outside of the crankcase as is reasonably practicable. Some designers have gone further by finning nearly every part of the engine, which is quite good, provided that it does not defeat its own purpose by obstructing or diverting air flow from the essential surfaces; finned silencers are not at all uncommon, and it is a good idea to cool the exhaust gases as much as possible, but my own experience is that this has much less effect on performance than keeping the crankcase cool.

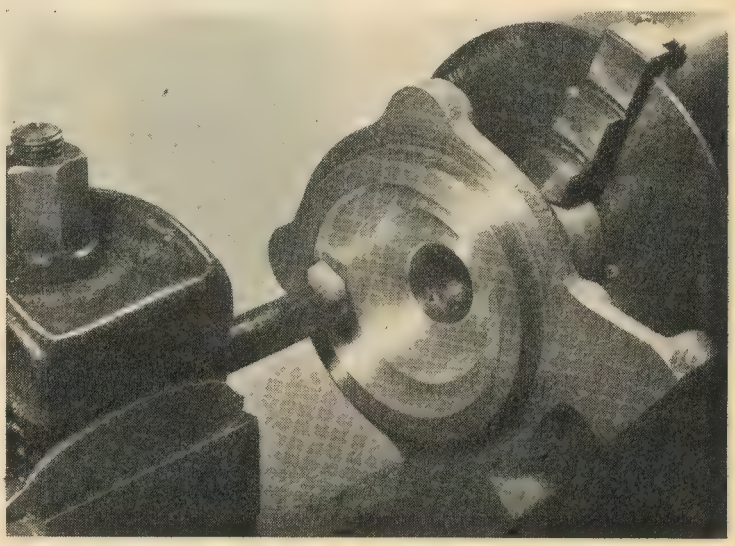
The "Bumble Bee" crankcase can be held in the four-jaw chuck, for boring, and facing on one side, after which it can be held by the bore, over the jaws of the self-centring chuck, for facing the other side. Great care must be taken to get the latter quite parallel to the side first machined, otherwise the bearing housings will be thrown out of line, but this is a matter which is easily checked, either by careful measurement, or by the use of a test mandrel through the bearings in the assembly stage, and correction, if necessary, can be made by scraping the face which was machined at the second operation. If one is not confident about the facial truth of the chuck jaws, it is possible to mount the casting on the faceplate by improvising toe-clamps tapered at the tip to go between any two of the fins; concentric truth is of course unimportant in an operation involving only facing cuts.

It is possible to face the top of the crankcase, and bore the seating for the cylinder spigot, by mounting the casting on an angle plate, and it may be done this way if convenient, and provided that the angle-plate has really accurate 90 deg. faces. A different method, however, which gives closer inherent limits of accuracy, was employed in my own case, and will be described in due course. Whatever method is employed, however, the casting must be set up to present the top surface as squarely as possible (i.e., parallel with the faceplate) in the transverse plane, and centred truly; note that the cylinder centre is offset $\frac{1}{4}$ in. from the centre of the seating flange, and this measurement should be checked rather than relying on the location of the cored hole, which may possibly be out of truth. The depth of the counterbore for the spigot should be sufficient to clear the end of the latter, and the diameter of the smaller bore 1/32 in. or so larger than that of the cylinder.

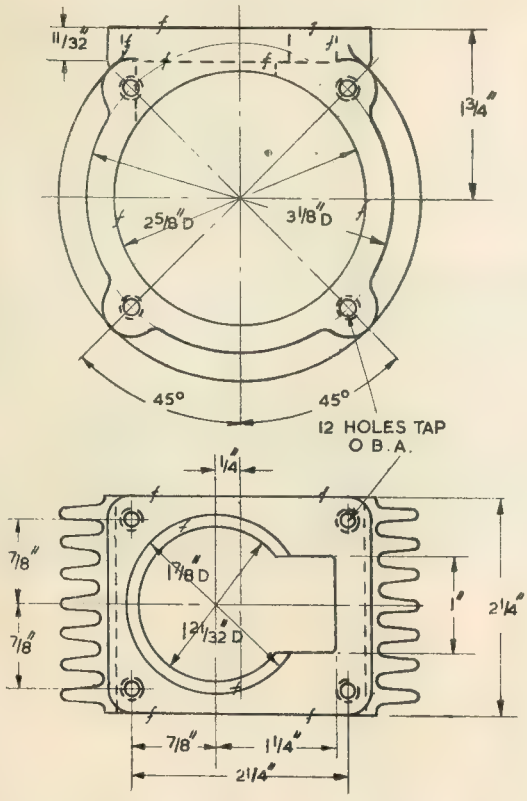
Main Bearing Housings

The two housings are identical, and the major machining operations can be carried out entirely at one setting, the casting being held by the outer boss in the four-jaw chuck. The joint face and the spigot should be machined—note that a close fit is desirable on all parts which register in this way, to ensure positive location and alignments, and also relieve the studs or bolts of any possible side stress. Next the housing can be bored to take the bush, allowing $1\frac{1}{2}$ to 2 thou. interference, and counterbored to two diameters to take the ball-race and its retaining plate respectively. The fitting of the ball-race is highly important, and I find it desirable to make it tighter than is usually recommended by the manufacturers, because of the difference in the expansion of the ball-race and the light alloy housing. Up to about 1-thou. interference does not seem to affect the running friction of the race when the engine is cold, and any possible tightness is relieved when it warms up. Note that the centre of the ball-race seating is relieved to prevent the inner ring rubbing against the light alloy.

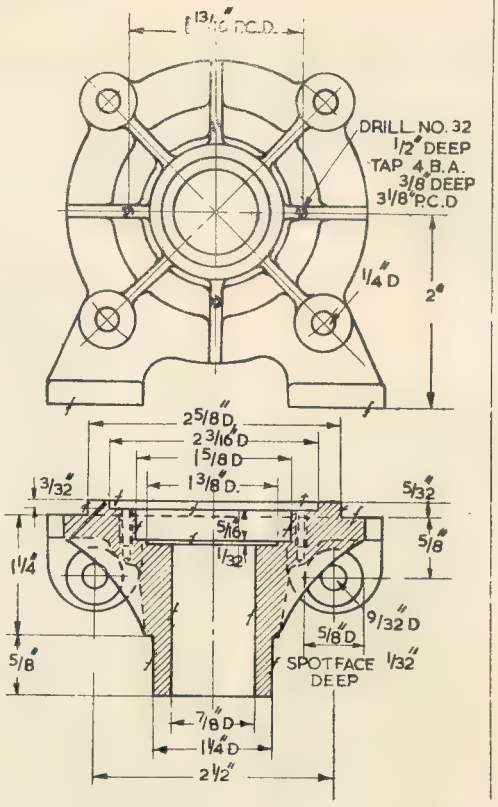
With correctly fitted races, retain-



Recessing one of the main bearing endplates



Crankcase—1 off, aluminium alloy



Main bearing housings—2 off, aluminium alloy

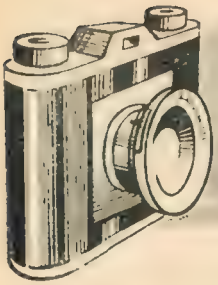
ing plates are not really necessary, and in the case of the "Busy Bee" such provision was made optional, but not specially recommended. In some of these engines, however, trouble was encountered through the races becoming loose, and though endwise movement of the shaft could not take place if the end play was properly taken up as specified, the creepage of the race would wear the housing still further and cause excessive side play. It may be that in such cases the initial fitting of the races may not have been so good as might be desired, but in any case it is desirable to avoid the possibility of such trouble arising. By fitting retaining plates, the races are not only located positively endwise, but also clamped so that they cannot creep. The depth of the counterbore in which they fit should be of such a depth that the face of the ball-race is slightly proud of the recess, so that the plate will bear firmly on it when screwed down.

For machining the outer boss on its face and diameter, the housing should be mounted on a mandrel to ensure concentricity with the bore. This is most important at the flywheel end, as the magneto backplate is mounted on the boss, but it is possible that something may be fitted at the other end, which is required to be equally true with the shaft.

The underside of the feet of the housings may be machined by clamping them to an angle-plate on the faceplate, a single bolt through the bearing being sufficient to hold the casting in position. I recommend that this bolt should be provided with a bush turned to fit the bore of the housing (or the bearing bush, if already fitted) and positively fixed to the angle-plate, so as to locate each of the two castings in the same position. The advantage of this is that it enables the face of the feet to be machined to exactly the same distance from the bearing centre, by checking the reading of the saddle or top-slide index. It is important that the housings should be uniform in this respect, to enable the feet to bed down truly when the engine is mounted on a flat surface.

Bearing bushes of "Oilite" or other oil-impregnated bronze are recommended for this engine, as they can be fitted to fine limits without risk of seizure, and have excellent qualities both as bearings and as packing glands. In inserting these bushes, the inner surface should be supported against collapse, by means of a close-fitting mandrel, and they must be kept in perfect alignment with the axis of the housing during the process. Failing the availability of a suitable press which can be guaranteed to preserve the alignment, I recommend screwing the end of the supporting mandrel to serve as a drawbolt, in conjunction with a nut and a broad, thick washer on the end of the housing boss.

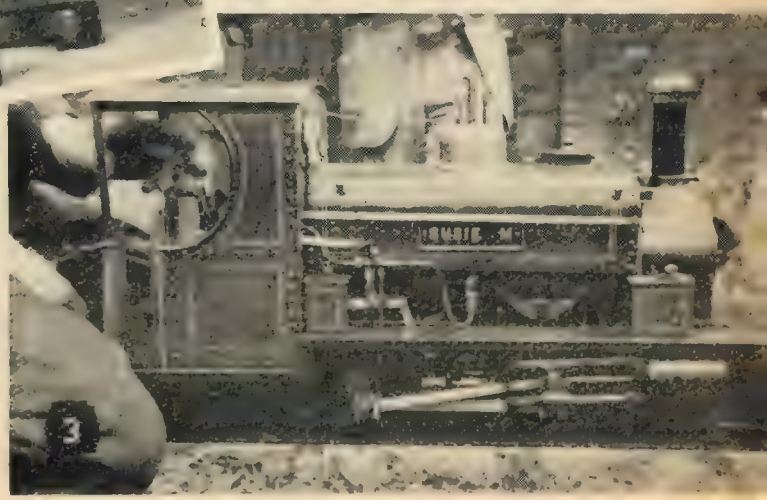
(*To be continued*)



Focus on Readers' Work

REACTION to this feature has been good, and we are pleased to present another interesting selection of photographs of the work of some of our readers. These are pleasantly varied, we think, but it will be observed that those die-hard locomotive, traction engine and model boat enthusiasts remain quietly insistent on having their " haporth of space " . . . Lor' bless 'em !

Models of horse-drawn vehicles made by Mr. R. W. Day of Ashford, Middlesex, are featured in Photograph No. 1, but the interests and abilities of 76-year-old Mr. Day range wide, and he has created small-scale replicas of a 1903 Ford car, an old-time fire engine, and a speed boat (radio-controlled) among other models. Here we see a delightful representation of the Coronation Coach, " drawn " by eight stately Windsor Greys which were fashioned in plaster, whilst in the foreground the team of four greys harnessed to a luxurious coach, are faced by Dobbin and the Romany-style caravan. Signal for



Readers are invited to send in photographs of their work which we are always pleased to use on this page. As can be seen from the current selection, the work embraces quite a wide field, so don't hesitate to let us have any photographs which may be of interest to others.

the start of model-making, in Mr. Day's case, came when he had put 70 years comfortably behind him.

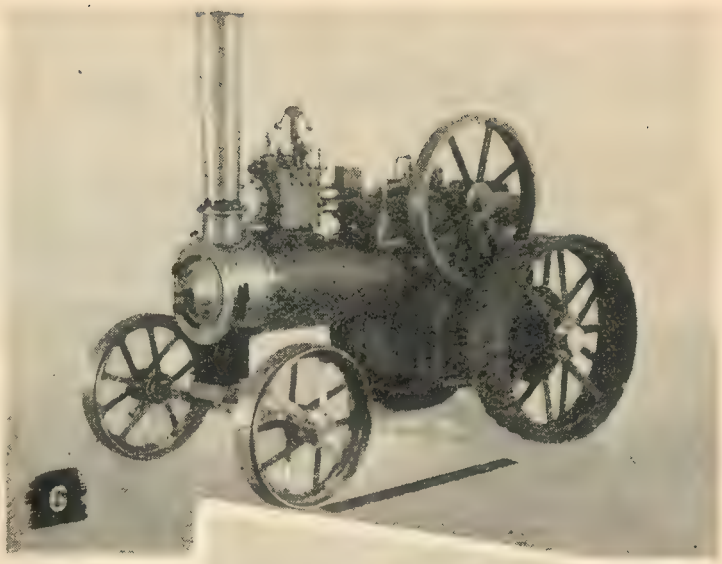
Reader N. McEachran, Darlington, Co. Durham, has given himself the freedom of many a new and unexplored world with his Sparey Microscope, but this is one with a difference. . . . Unorthodox execution lies in the use of mild-steel fabricated sections for foot and limb of the instrument shown in Photograph 2. These were electrically-welded and very little machining was necessary. Joints were deeply vee-grooved for weld-penetration; surplus metal was ground-off and filed smooth.

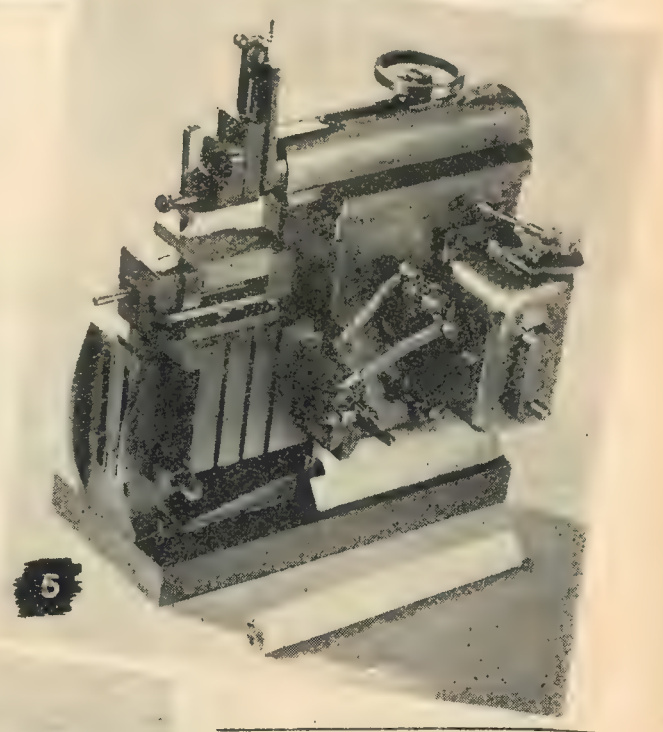
The prim-looking lady full of " drive and ability "—No. 3—is a husky little locomotive which was constructed in 785 hours out of the two years devoted to it by Mr. M. E. Moon, of the North London Society of Model Engineers. Readers may have seen her on the track at the " Model Engineer " Exhibition. The locomotive is 1/7 full size, weighs nearly a hundredweight in working order, and develops approximately 40 lb. tractive effort at 80 lb. boiler pressure. The prototype was built by Hunslet in 1895, for the Dinorwic Quarry Co., North Wales, and was named " Jerry M."

From Mr. Arnold Eastham of Bramhall, Cheshire, comes Photograph No. 4—of an impressive little model tugboat which sits on the water " all shipshape and Bristol fashion," and is complete even to fenders and pennant a-flying. The length of the model is approximately 3 ft., and it was photographed at a pond on Lindow Common, nr. Wilmslow.

A refreshing choice of subject is seen in the model (No. 5) made by Mr. V. Fordred of Finchley, London, N.3. This is a 1 in. to 1 ft. replica of a 12 in. Ormerod shaping machine, and an excellent idea of its dainty (dare one use the expression ?) proportions may be obtained by comparison with the cigarette.

Finally, in Photograph 6, (showing the work of Mr. Winterton, former member of Stockport S.M.E.) we see a traction engine model which loses nothing by being partly completed.





May we see YOUR contribution to this page?

Photographs are paid for at our usual rates, but should be suitable for reproduction, i.e., good, sharp prints which are not too small.

An Exhibition at Burnley

Reported by
" Northerner "

One of T. M. Parker's coal-fired " O "-gauge locomotives, this experimental Atlantic has Baker valve-gear

SPONSORED by the local Rotary Club, a Hobbies Exhibition was held recently at Burnley in Lancashire, representing such widely diverse activities as Esperanto, rabbit-keeping, collecting cigarette-cards, carving, embroidery, and photography, among many others. To anyone interested in the way of the world, all these exhibits gave great pleasure, and your reporter was no exception.

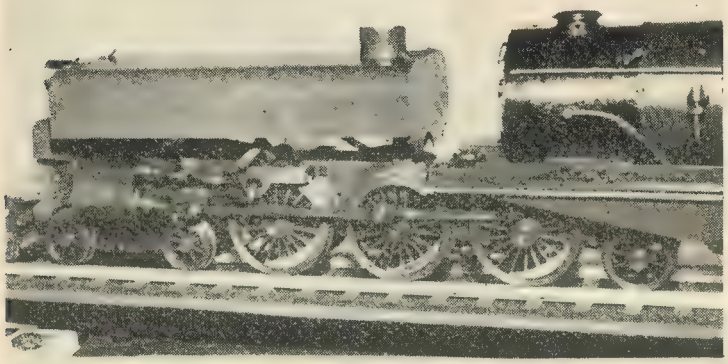
But no exhibition of hobbies could be complete without model engineering, and although our craft was not overwhelmingly represented in numbers, the quality of the work was very high. For example, one of the most popular exhibits was the roundabout of our old friend Mr. Slack, which is now so familiar to television fans of " Whirligig."

For the Rising Generation

First, however, I want to mention the Towneley Model Club, which is conducted by Mr. E. St. John, A.M.I.Mech.E., A.F.R.Ae.S., of Nelson. The club is run as one of the activities of the Towneley School Youth Club, and Mr. St. John is doing a very good, and exceedingly valuable job of work in training boys in the art of model boat-building.

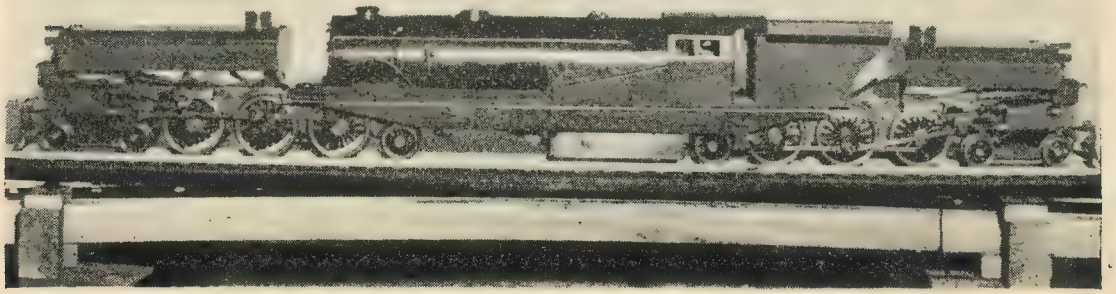
It is valuable not only from the view-point of gaining adherents to our fraternity, but also because none of these lads can fail to benefit from the training of the co-ordination of brain, hand, and eye which they are receiving at the instruction of Mr. St. John. No wonder that this boat-building class is highly popular!

The classes are held weekly during the winter months, and during the session each boy constructs a complete model, all pupils working to the same basic design. During the past three winters the subjects have been respectively a tug-boat, a police launch, and a speed-boat, whilst next winter the model will be a cabin cruiser based on a proto-



Left: The leading 4-6-2 engine of Mr. Parker's Garratt; valves are driven by slip-eccentric

Below: This " O "-gauge coal-fired locomotive is based on the 3 ft. 6 in. gauge Garratts of New Zealand; it has six cylinders



type built by Graham Bunn's of Wroxham.

Examples of the models have been shown at the Northern Models Exhibition every year, and awards have been gained by club-members each time. Readers will remember that the Lawton Trophy, for Junior work at this show, was gained this year by John Horne, for a nice 24 in. speedboat. This was built at Mr. St. John's class.

Most of the models are electrically propelled, but some, like John's, have diesels, and radio control is also being used. Incidentally, John has fitted an ingenious air-bleed device, developed for radio-control by him and his mentor, which will allow the engine to be run at fast or slow speed as desired.

Work by Club-members

John's boat, with his trophy, was exhibited on the club stand, and close by was another 24 in. speed-boat of the same basic vintage. This had been built by Alec Heap, aged 12; it was electrically driven, with a hull built of ply on hardwood stringers, with ¼ in. thick balsa frames. The deck was mahogany finished and neatly lined, and the seats were upholstered in velvet cord. Considering Alec's age, the finish was very good.

Some of the club members have also built " private " models besides the club designs, and one of these was a well-built 18 in. sailing dinghy by Ernest Duckett of Laneshaw Bridge. It is clinker-built with thin ply planks on plywood frames, the floor also being planked.

There are watertight compartments at bows and stern, and a brass centre-board is fitted for sailing. The rigging and fittings were neatly executed, and the whole model gave an impression of efficiency and tidy craftsmanship.

Another " private " venture was a sailing canoe by Christopher Thornber, aged 16. This was 3 ft. 6 in. long overall, and was built just like the prototype on ribs and stringers bent from hardwood strips, which were then covered with canvas.

A mahogany coaming surrounded the cockpit, and there were two knee-boards for sailing, with a double-ended paddle (carved from the solid) and a nylon sail to complete the picture. Once more this was a nice model—and an unusual one besides.

Probably the model canoe received inspiration from the Canoe Club, in which Mr. St. John is also keenly interested. This is another worthy activity of the Towneley School Youth Club, and some members have constructed their own canoes. During the exhibition, in fact, a number of the boys were actually at work on a 12-ft. folding single-seater, under the direction of Mr. St. John.

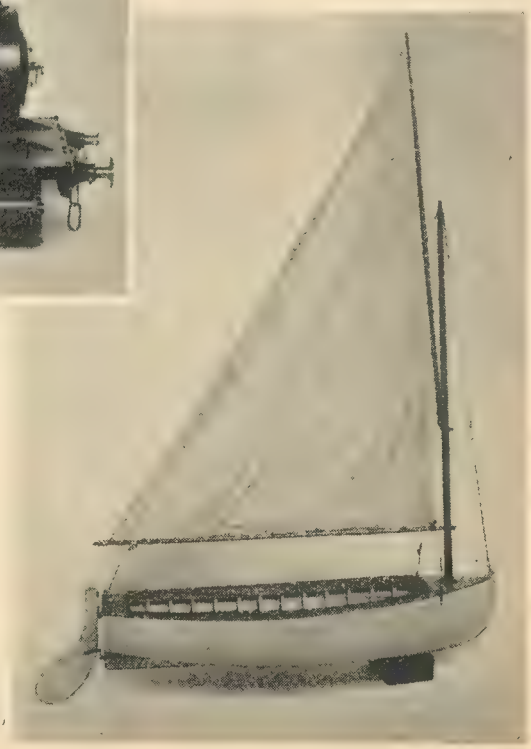
Close at hand was a 3½-in. gauge 0-6-0 tank locomotive built by Roger Thornber, who is now 21 years of age. The locomotive was commenced when he was 17, but National Service intervened before the engine was finished. This was a good sturdy-looking locomotive; the fitting was good, though the finish on both machining and painting could have been better. But doubtless the quality of these will improve as Roger carries on; he has certainly made an excellent start.

Championship Winners

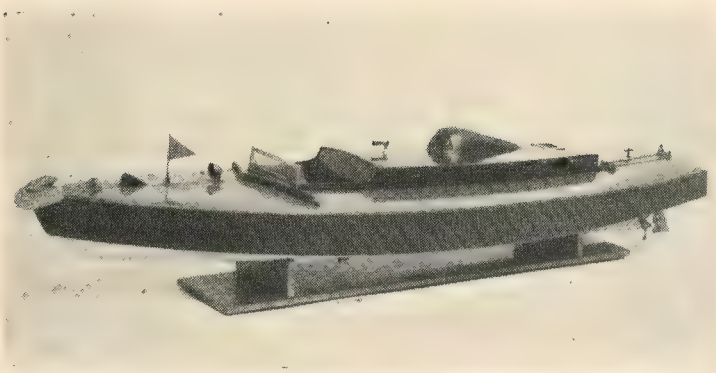
While at the exhibition I had the pleasure and privilege of meeting once more Dr. T. Fletcher, of Colne, whom I had last seen at the Leeds Exhibition the previous week. The doctor had not been able to send his models to Leeds, having promised them to Burnley, and here they were in their glory.

There was the tug *Chieftain*, whose " close-up " photograph was on THE MODEL ENGINEER cover last December, and the pilot-boat, whose twin-cylinder petrol-engine and gearbox were described and illustrated in my report of the Huddersfield exhibition on 26/11/53. Then there were Dr. Fletcher's well-known seven-cylinder

A 3½-in. gauge 0-6-0 tank engine built by Roger Thornber was started at the age of 17



Right: This sailing-dinghy 18-in. long built by Ernest Duckett was clinker-built on plywood ribs



Dr. T. Fletcher, of Colne, built this petrol-driven speedboat many years ago

radial aero-engine, and his lovely 3½-in. gauge Caledonian locomotive, as well as his delicately-modelled steam yacht.

All of these I had seen before, but one can always gain pleasure from fresh contemplation of masterpieces of this calibre. However, another of the doctor's models which I hadn't previously seen was a speedboat about 30 in. long.

The hard-chine hull was shapely and shallow, built on stringers and frames. It was powered by an air-cooled petrol engine, and a water scoop amidships delivered water to the exhaust-pipe to cool and silence the gases.

Steering was by a wheel in the cockpit, connected by worm and pinion, cranks and rodding to the rudder. The cockpit is arranged removable in one piece with the engine cover, to provide easy access to the hull interior.

Coal-fired " O "-gauge Locomotives

Another stand at the exhibition was that of the Burnley and Nelson Model Railway Club, consisting of a demonstration " O "-gauge layout built by father and son T. M. and D. M. Parker. The chief point of interest to me about this layout was that all the locomotives were steam-driven, and most of them coal-fired.

First of all was a Mogul based on the " Fowler " L.M.S. type, but this had a spirit-fired Smithies-type boiler. The cylinders were $\frac{7}{16}$ in. by $\frac{5}{8}$ in., and had slip eccentric valve-gear. This engine was built by Mr. Parker (Sen.) about 20 years ago.

One of the coal-fired engines was an experimental free-lance Atlantic, built about seven years ago. This had a bore of $\frac{5}{8}$ in. and stroke of $\frac{11}{16}$ in., with Baker valve-gear to drive the slide-valves. The engine is a great success, and is very powerful.

But the pride of the stud was an unfinished Beyer-Garratt 4-6-2—2-6-4 engine, based on those built for the New Zealand 3 ft. 6 in. gauge. This fine model has six cylinders $\frac{7}{16}$ in. by $\frac{11}{16}$ in., with slip eccentric valve-gear.

The coal-fired boiler has seven tubes, including two superheater flues, and steam is taken to the cylinders through correctly articulated ball joints in the steam-pipes. There is a tiny donkey-pump to feed the boiler, with a $\frac{1}{4}$ in. diameter steam-cylinder and $\frac{1}{8}$ in. ram, but Mr. Parker says this is rather temperamental, no doubt owing to its smallness.

The Garratt has been building for about fifteen years on and off; as the builder says, there is a great deal to it, and when he gets fed up he goes on to something else for a while.

All Mr. Parker's engines are sprung on all axles, and work at pressures of 80 to 100 lb. Without a doubt the use of steam on a layout such as this adds greatly to the realism, not only as to sight and sound, but also as to smell ! The odour isn't strong, by any means, but it certainly makes a lot of difference.

BARRING ROUND

AT a large ice works in the Midlands the writer saw the following incident take place.

There was a large tandem compound steam engine driving two ammonia compressors. The engine crank was on one end of the flywheel shaft, and on the other end was a crank driving the two compressors placed *vis-vis*, both machines being driven from one crankpin. The engine, fitted with Corliss valves and an early cut-off, was very troublesome to get started.

When starting, it would generally reach the end of the stroke, and very rarely did it make the return stroke. It was provided with " barring gear," for turning it to starting position, and anyone available was called upon to " bar round." This performance irritated " Wilfred," the chief engineer, and his language was not of the best during operations.

But the climax was reached this day when one of the firemen, a Welshman (who could hardly write his own name) and who had been watching the struggle through a glass panelled door, opened the door and said : " Wilfred, why don't you go about it the right road and get it going ? "

The look of surprise and scorn on Wilfred's face was beyond words. At last he managed to shout : " Perhaps you would like to have a go."

" I wouldn't mind," says the fireman, and after waiting to hear a bit more language from Wilfred, he calmly walked over to the compressors and screwed the *inlet* valves down. " Now, lads," says the fireman, " bar round again for the last time."

This being done, the fireman went to the engine stop-valve and opened out. The engine having been *unloaded* by closing the inlet-valves on the compressors, started quite freely, and the valves were then reopened.

But it was hard to define the feeling which existed between Wilfred and the fireman after that !— P. ROBINSON.

The use of Limited Equipment

THE FASCINATING STORY OF THE CONSTRUCTION OF THREE 2½-in. GAUGE LOCOMOTIVES

By J. St. Hilary Webb

THERE must be a considerable number of enthusiasts anxious to produce models of their fancy, but deterred from doing so by the thought that a considerable amount of workshop equipment is an essential prerequisite. I was in this unhappy position four years ago; for a long time, I had cherished the ambition of constructing a passenger-hauling locomotive, but the financial outlay which appeared necessary was, at that time, a formidable obstacle. Clearly, the major requirement was a lathe and, for a while, serious thought was given to the possibility of making one; unfortunately, in order to do this, the use of a lathe appeared essential and this was not possible. Eventually and for a very small sum of money, I purchased a 1⅝-in. "Super Adept," a ¼-h.p. electric motor and a countershaft; the equipment with the lathe consisted of one four-jaw independent chuck and one tailstock drill-chuck. With this as my only machine tool, two of the 2½-in. gauge locomotives illustrated were built, and it is my sincere hope that this account of my experiences will encourage other ill-equipped enthusiasts to attempt what has, perhaps, been thus far considered beyond their means.

First, let me list the tools which were in my possession, in addition to the Adept lathe. As far as I can remember, these consisted of a 12-in. steel rule, dividers, calipers, centre punch, scriber, set-square, hammer, hacksaw, micrometer, die-holders, tap-wrench, scribing block, wheel brace, 3-in. vice, pliers, a small number of drills, taps and dies and a few files. Several of these tools were made by me some years ago. A small number of tools were purchased as construction of the first locomotive proceeded, these being mainly 40-t.p.i. taps and dies; other requirements, such as reamers, pin-drills and turning tools were home-made, using silver-steel. To the foregoing list, one most essential requirement must be added—namely, enthusiasm; without this supreme *tool*, the job selected is impossible; but with it, the lack of equipment is soon forgotten.

In selecting a suitable locomotive to build, the governing factor is undoubtedly the diameter of the wheels since, in my experience, these constitute the greatest challenge to a very small lathe. With this in mind, my own choice fell upon the 2½-in. gauge locomotive *Austere Ada*, designed by "L.B.S.C.", the coupled wheels being only 2¼ in. diameter. Having obtained a set of blueprints from a MODEL ENGINEER advertiser, a start was made. Naturally, the frames were the first components to be taken in hand; they presented no difficulty, although most of the holes were necessarily drilled with a wheel brace. At that time, hot-pressed hornblocks were not available, and a considerable amount of careful filing was necessary on the sand castings that I used. Due to lack of suitable machining facilities, the axleboxes were built up from ⅝ in. × ⅜ in. steel bar, to which the 1/16 in. thick flanges were riveted. As with locomotives which I have built subsequently, the undrilled axleboxes were then mounted in the frames and the axle positions marked by reference to a common

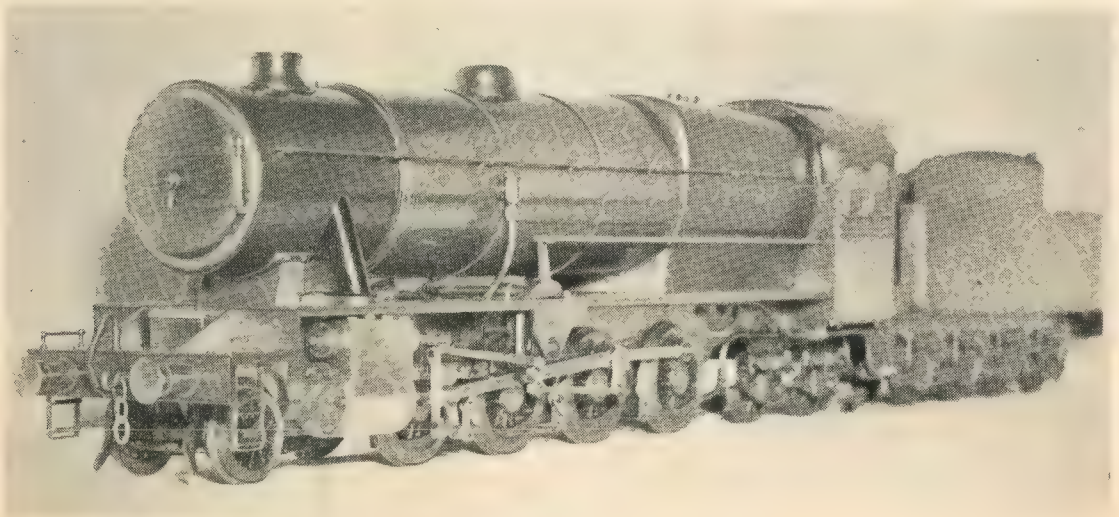


Fig. 1. A 2-8-4 rebuild of an "Austere Ada"

datum, such as the vertical centre-line of the cylinders. They were then bored to $\frac{7}{16}$ in. diameter in the lathe and fitted with bronze bushes. This method ensures that any error in the location of the horns has no affect upon the axle positions.

The wheels presented the first major difficulty, largely due to the absence of back-gear, coupled with the lack of adequate tool grinding facilities. To anyone contemplating such work on a lathe of this type, I would suggest that a new mandrel be made, about $\frac{3}{4}$ in. longer at the tail end, in order that a large pulley can be mounted for slow speed turning. Alternatively, the existing mandrel can be reversed in the head-stock and drilled 9/32 in. diameter to a depth of $\frac{3}{4}$ in. to allow the fitment of an extension shaft. I ultimately carried out this modification to my own lathe, but not until a second locomotive was being built, having somewhat larger wheels. However, to revert to the original subject, I found it impossible to obtain a satisfactory finish by turning; so, after roughing out, the wheels were made presentable with files and a carborundum stone.

The axles were machined in a somewhat unusual manner since their diameter is the same as that of the Adept mandrel. Consequently, four lengths of silver-steel were cut to length and mounted in the head-stock bearings in lieu of the mandrel, in order that the wheel seats could be turned. This ensured absolute concentricity, the alternative method being to turn oversize material all over, between centres. Pressing the wheels on the axles at the appropriate angle was not easy; in this instance, I adopted the method advocated by "L.B.S.C.", but frankly, I feel that it is somewhat hazardous. When building my second locomotive, I made up a set of dummy coupling-rods, but this method is also unreliable. For the third locomotive, a proper jig was made, which is described and illustrated later in this article.

I was particularly anxious to fit fluted connecting-rods, and a method was evolved which may commend itself to others lacking equipment. This consists of filing a slot having the same dimensions as the flute, in a piece of 20-gauge steel, and then sweating this to the connecting-rod. After cleaning up, the fact that the rod consists of two pieces is scarcely discernible.

Cylinder castings were obtained with the ports already cast in. The machining of the bores and facing one end of each cylinder were carried out by a friend, but on my second locomotive, these operations were carried out in the "Super Adept," simply to prove that such a task could be undertaken where no assistance was available. All the remaining surfaces were hand-filed, including the port faces. To anyone else forced to adopt this humble method, I would advise sawing the bosses off the steam chests, and adding separate ones after machining, since the diameter of the bosses exceeds the depth of the steam-chest and renders filing difficult.

Further work on the chassis presented no difficulty and I had the pleasure of "watching the wheels go round," under the influence of compressed air, twelve weeks after the commencement of the job. The boiler was brazed with the aid of a five-pint blowlamp and the actual engine was completed, including painting, in six months. The tender occupied a further two months' work; in the interest of economy, the tender body is of steel, and has a separate copper water tank, the copper actually being in my possession at the time, having previously served duty as a covering for a public house bar!

By this time, I had made the acquaintance of a gentleman possessing about 80 yd. of 3½-in. gauge track, and he readily consented to the laying of a third rail to allow my engine to be run. The first steam trials ended in tragedy, due entirely to carelessness. The glass tube in the water gauge was too long and, in obscuring the steam way in the top fitting, caused the water level to be faultily recorded. The consequence, detected too late, was a nearly empty boiler and the solder sealing the boiler stays failed. Repairing the damage was not easy, since the firebox was naturally very dirty. Finally, the difficulty was solved by directing a blowlamp flame into the firebox for a while and then pouring in a quantity of Baker's fluid; the violent ebullition which followed effectively cleaned the job and re-soldering then presented no problem.

After this inauspicious beginning, the engine gave no trouble, and ran for many hours both on the track and on the bench.

Shortly after this, I was obliged to reside in a caravan for a while. The loss of a workshop was a bitter blow and, after two months of miserable inactivity, one was constructed. Its dimensions may cause a smile, but again may serve to offer encouragement; the length and height were six feet and the width, three feet ten inches. Electric current was led by cable from a farmhouse, and a problem arose in that starting my motor naturally caused the lights temporarily to dim, to which the farmer's wife objected. After spending some time endeavouring to find a remedy by electric devices, a solution was eventually found. I purchased a hand-driven generator from a MODEL ENGINEER advertiser. The gearbox of this device was mounted under the bench with a belt-drive to a pulley on the motor. A few vigorous turns of the handle soon brought the motor up to its 1,400 r.p.m., and switching on then had no affect upon the lights.

Thought was then given to the question of what to make, and I finally decided to re-build *Austere Ada* in the light of the running experience which had been gained. Its performance had never impressed me, largely in so far as the characteristics of the boiler were concerned. Let me stress, however, that my adverse criticism of this boiler may well be founded upon lack of

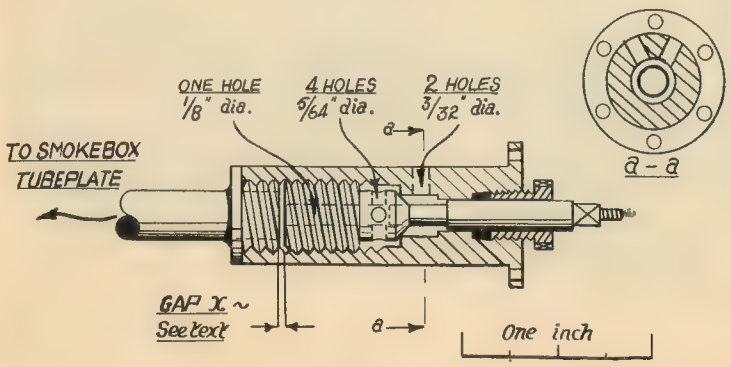


Fig. 2. Simple, but effective regulator fitted to the 2-8-4 engine

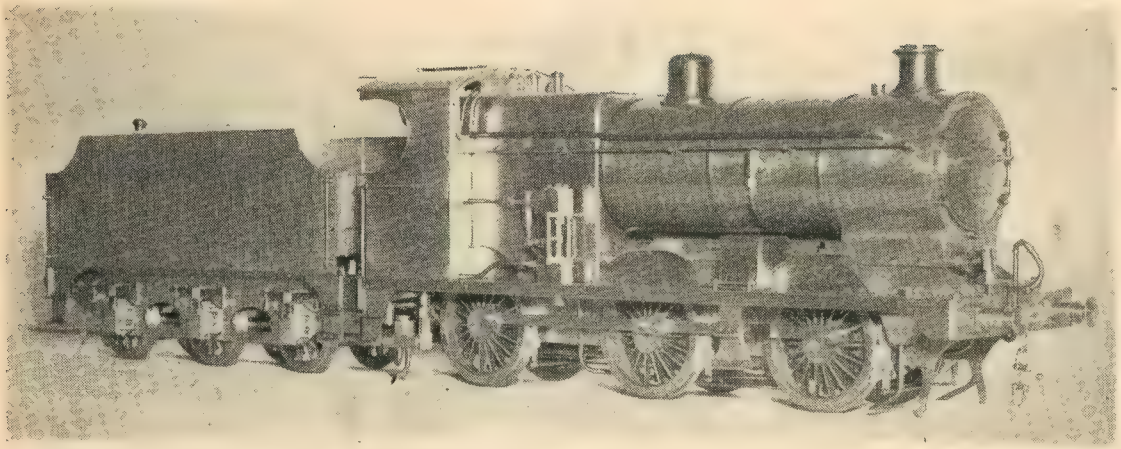


Fig. 3. A free-lance 0-6-0 locomotive based on a L.M.S. type "4F"

experience in handling small boilers at that time. In brief, I feel that what is wanted for satisfactory service on a short, up-and-down track is a boiler having a considerable water capacity relative to the heating surface in order to endow it with a measure of docility. In addition, I was always very concerned about the smokebox temperature of my locomotive, this being evidenced by the fact that the smokebox ring was machined slightly undersize and was secured—but not for long—with soft-solder, which ran out in molten pools. On the other hand, a locomotive belonging to a friend, which was certainly no more efficient in so far as the cylinders and valve-gear were concerned, could safely be entrusted for long periods to a small boy, so great was its ease of handling. This I attributed to the design of the boiler. In consequence, I rebuilt my locomotive as a 2-8-4, and it is shown in its modified form in Fig. 1. The original chassis was retained but was lengthened by the addition of extension-pieces which carry the trailing truck. This revised layout also improved the weight distribution on the coupled wheels and overcame the "nose-heaviness" which was formerly in evidence. The only other major change to the chassis involved a new water pump, having a bore of $\frac{3}{8}$ in., this being $\frac{1}{16}$ in. greater than the original. This was considered advisable since, previously, it was necessary to enlist the services of the hand-pump periodically. Some may assert that such a demand for water is indicative of badly built cylinders and valve-gear, but I cannot agree to this. After all, on a short, undulating, up-and-down track, most of the running is carried out using "all the lever," or else the engine is at rest, while passengers arrange themselves; heavy water and coal consumption is, therefore, inevitable. The new boiler is precisely similar to the original, but has a barrel and tubes 4 in. longer. It is encased in a dummy tapered barrel and Belpaire firebox and is lagged with asbestos up to a maximum thickness of $\frac{3}{16}$ in. A new regulator was also fitted; this is shown in Fig. 2, and has proved completely satisfactory. Speaking personally, I much prefer to make a screw-down valve of this type rather than a disc valve. True, the steam in this design is collected towards the rear of the boiler, but in practice, this seems to have no observable effect. In the case of this engine, the thread of the valve is $\frac{3}{8}$ in. Whit., and a $\frac{1}{4}$-turn of the valve passes all the steam that the boiler can make; consequently, the gap marked x on the drawing is set at 1/64 in., so acting as a stop.

The engine, as re-built, has spent countless hours in steam, frequently for eight hours at a stretch, and has proved completely satisfactory. The boiler can be grossly abused with but little effect. The working pressure has been successively reduced from 100 down to 50 lb. per sq. in., largely due to the engine's wheel spinning propensities. This I attribute to the coil spring suspension, with its inherent lack of damping; later, alternative systems will be tried.

The second locomotive to be built is shown in Fig. 3, it is based on an "L.B.S.C." design for an L.M.S. "4F," but has been altered externally in so many respects, that it is prudent to class it as free-lance. Most of its construction is in stainless-steel, for the encouragement to use which, I must thank Mr. Austen-Walton. Certainly, in my own case, this material is used now wherever possible. It is all very well to claim that such-and-such a brand of oil positively prevents rust; the only comment which I can make is that the conditions imposed in the makers' laboratories must be appreciably less searching than those encountered in the average model engineer's workshop. However, to revert to the 0-6-0, builders using blueprints supplied by a certain firm would be wise to beware of one or two points. First, the overall distance across the cylinder slide bars is $1\frac{1}{2}$ in., whereas the space between the hornblocks, between which the slide-bars are intended to fit, is $1\frac{3}{8}$ in., which renders assembly somewhat difficult, particularly if, as in my case, you fail to detect the error until the components are made. Secondly, if you intend to fit the displacement lubricator shown on the drawing, you will need to find somewhere else to put it, since it requires at least $\frac{1}{2}$ in. more space than is available. You will also find that a water pump made to the drawing extends over $\frac{5}{16}$ in. below the railhead and that the valve chamber is some 5 deg. from the vertical. I may appear to be unduly critical, but it seems to me that having paid a comparatively large sum for a set of blueprints, one expects at the very least, that they be quite free from error.

(To be continued)

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

A TRACTION ENGINE IN STEAM

DEAR SIR,—I am writing this letter in the hope that it will catch the eyes of fellow West Country traction engine enthusiasts. At Coombe Caravan Camp near Camborne, Cornwall, there is a S.C. Compound "Burrell" traction engine No. 2882, and according to her owner, Mr. C. P. Gregory, she will be 50 years old on June 9th this year. On that day I shall have her in steam, crushing in some newly made road at the camp; all interested are very welcome to come along on that day.

I have recently re-tubed the boiler of this engine, and at present I am cleaning and re-painting her in my very limited spare time.

Yours faithfully,

Redruth. J. WARREN.

LATHE CROSS-FEED

DEAR SIR,—It was with interest that I read Mr. R. H. Pilcher's introductory remarks to his article "An Automatic Cross-feed for the M.L.7 Lathe" (THE MODEL ENGINEER, 22/4/54), as I have often heard complaints over the tediousness of hand cross-feeding.

For those who lack the time to carry out Mr. Pilcher's excellent instructions, or for those who would like to get more enjoyment from their work whilst making the attachment, it is hoped that a few remarks on some of my own experiences on hand cross-feeding would be of interest.

First, I should like to emphasise the fact that there is not the slightest need for the cross-slide gib and adjustment to be so tight as to render hand feeding an effort similar to that required for tapping a $\frac{3}{8}$-in. B.S.F. thread in mild-steel.

The cross-feed handle as normally fitted by all lathe manufacturers is very rightly referred to by Mr. Pilcher as a "fiddling little handle" and it is, of course, quite impossible to impart a smooth rotary motion to handles having such short radii. However, there are three chief modifications which can be easily carried out, any one of which will effect a considerable improvement, and make hand cross-feeding more of an operation to be looked forward to.

The simplest of these is to replace the gib adjusting grub-screws by cheese-headed, especially made so that the threads are "full" and slightly stiff, the usual lock-nuts being discarded.

The reason for this is to facilitate the frequent adjustment of the gib-screws to meet the varying requirements, thus, for facing cuts they should be so adjusted that the slide does move easily, whilst for parallel cuts, where the cross-slide is used merely to add a few thou., it should be tightened just sufficiently to prevent vibrations altering the setting.

Whilst on the question of gib adjustment, mention should be made of a point which is frequently overlooked; that is, that whenever work is bolted to the cross-slides of small lathes, a certain amount of distortion always takes place, this usually having the effect of tightening the slide, but sometimes it will loosen it. In any case the gib-screws should be re-adjusted to give a nice feel.

The second modification should consist in the making of a new ball handle. (A wheel is not to be recommended, as, in the event of it being desired to mount a projecting assembly on the cross-slide, such as for boring, when the cross-feed is not required, a wheel would get in the way.) The new handle should have a radius as large as possible consistent with not looking out of place on the machine. The photograph, reproduced herewith, illustrates one of $1\frac{3}{4}$ in. radius, which looks well on a $3\frac{1}{2}$-in. lathe.

The third modification is optional, but I have made the change and never regretted it; replace the original feedscrew with one of 16-t.p.i. "V" thread ($\frac{3}{8}$-in. Whit.). This gives further mechanical advantage and allows the operator to indulge his natural impatience and turn the handle a little faster when facing, but without making a gramophone record of the job. For example, typical finishing facing cuts made by the writer, with a Myford M.L.4 lathe are:—

Mild-steel work up to 3 in. dia.

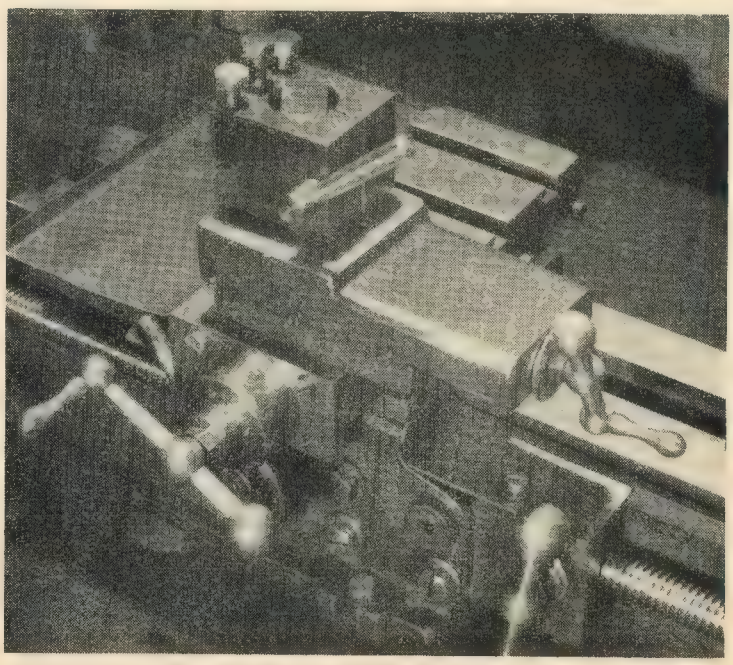
18 per cent. tungsten H.S. tool.

Speed: r.p.m. 1,100 (eleven hundred).

Depth of cut: 0.003-0.005.

Feed: about 0.0034 in. per rev. of work.

The feed is obtained by turning the cross-feed handle at 60 revs.



per minute with a 16 t.p.i. cross-feed screw, quite a good fine finish being easily obtained, a finishing cut on a 3 in. disc taking 24 sec.

The photograph also illustrates an extension-piece bolted to the apron to allow for the fitting of a large radius handle to the traverse rack feed, a travelling chip-tray fitted to the saddle to protect the lathe bed, and a quick-acting adjustable-height type toolpost on the top-slide.

The graduated collar for the cross-feed has 65 divisions, each giving 0.00098 in., and a vernier reading to 0.000098 in., the latter being not for the purpose of taking cuts of 0.0001 in. in depth, but to enable the slide to be reset *exactly* where it was before, for taking finishing cuts on repetition work to close limits, eliminating the original mental necessity for remembering the required size was obtained by setting to 23 " and-a-bit," the " and-a-bit," being read off as 2/10 or 3/10 or whatever it was, of a division.

There is one exception to this easy cross-feeding stuff. When setting up for milling, the gibs should be re-adjusted so as to be on the stiff side, otherwise the milling cutter will rattle the job all over the place.

Yours faithfully,
Hastings. K. C. H.

GARRETT TRACTOR

DEAR SIR,—The picture by Mr. Dingle of the above nice little engine reminded me of a very unpleasant time I had on one of these. This was due to the very big fault of a bad regulator on this class of engine. I was steering the engine, and we had either two or three show loads coupled to us. We stood at the top of a nasty hill to set brakes on trucks, and then got the O.K. to move. As the engine didn't start up (it *had* been put in low gear), the driver " touched " the regulator and off we started. As we proceeded, the speed increased, till the motions were indistinguishable from a blur. Well, a motor is better to steer the faster it goes, but on " chains " it's not so funny ! Anyway, I stuck to the wheel and was ready, if it really became necessary, to ram into the soft bank at the side of the road. The trouble was that I did not know where the man who set the brakes was walking, if on the near-side or off-side.

Anyway, we got down the hill, and an opposing hill pulled us up safely. On arrival at the next pitch, we found the flywheel had shifted 1½ in. along the shaft towards the road wheel. When the engine was cold, I took the cover off and examined the regulator. And I found it was the spring on the pull-rod that caused the valve not to seat properly. The valve had a solid connection with the regulator-rod, as the rod was carried through two forks, front and back of the valve. Now, other classes I've seen have a fixed section to rod, *but* the actual valve is independent under this and has freedom to be seated at all positions on the face of regulator seating, as steam can press down freely on it. Otherwise they were good and pretty-looking little engines.

Yours faithfully,
London, S.E.2. ALAN BLOW.

A 10-WHEELED " SENTINEL "

DEAR SIR,—At the beginning of April, I travelled on the branch line between Wimbledon and West Croydon and I saw a steam lorry in a yard near Beddington Lane Halt. I was able to explore this recently, and I found several steam wagons with tar tanks still being used; but, at one end of the yard there was a ten-wheeled ' Sentinel ' steam wagon with pneumatic tyres and fitted with a tank and small petrol-driven pump. The lorry or wagon is derelict, but I learned from a steam-roller driver that he had driven it up to the yard three years ago and it had not been touched since. The tyres are deflated and the paintwork is in very poor condition; but it seems to have been very well maintained, for the window winding mechanisms and catches in both doors worked very well.

My whole reason for writing you is that the fact that this wagon is apparently in fair condition and unused, points to the idea that it may be saved from the scrap-heap if a club or clubs can raise enough money to buy it.

There are also at this yard two partly-dismantled steam-rollers and one traction engine. There are three steam-rollers in almost daily use.

Yours faithfully,
London, S.E.20. R. H. WILSON.

MR. HICKEY'S " BURRELL"

DEAR SIR,—The reference to Mr. Hickey's Burrell road locomotive which appeared in a letter by Mr. G. C. Dingle published in your issue of April 22nd rather interested me. Mr. Hickey is justly proud of his fine Burrell, and on the occasion that I last saw her (two or three summers ago) she had just been overhauled, and I believe her owner told me he intended using her for moving heavy boilers in the yard. At that time, Mr. Hickey gave me permission to take several photographs, the negatives of which I still have in my possession. Unfortunately, the background turned out to be slightly confusing, and as the Burrell was not in steam at the time, I hardly felt justified in asking for her to be moved.

I think Mr. Dingle is slightly in error when he calls this engine a " scenic," for it is really a typical contractor's road locomotive. I would also like to commend to his attention, if he has occasion to visit the Hertfordshire-Essex border again, a very fine Burrell general purpose engine owned by a Mr. Paris of Hastingwood, and formerly used for threshing, not to mention a pair of Fowler ploughing engines owned by this gentleman's brother, and which are to be found in a farmyard at North Weald.

In conclusion, I would like to mention that although I have not checked recently, until eighteen months ago the Essex County Council still had quite a few Aveling steam-rollers, and at least one Burrell in regular use, the last named being the only Burrell roller I have seen, and of which I am pleased to have a photograph.

Yours faithfully,
Waltham Cross. E. SINDEN.

Next Week . . .

" TITFIELD THUNDERBOLT "
" L.B.S.C." gives further details for the construction of this popular historic locomotive in 5 in. gauge.

DIESELS ON THE RAILWAY
A description, with photographs and drawings, of the new Lightweight Diesel trains recently introduced on British Railways.

MORE ABOUT SMALL BOILERS
In the " Utility Steam Engines " series, further examples of water-tube boilers suitable for marine and stationary work are described.

PETROL ENGINES FOR POWER BOATS
" Meridian " discusses the production of castings for i.c. engines, suitable for model speed boats and other purposes.

BRAKE HORSE POWER
Apparatus and methods for bench testing small power high-speed engines are described by a well-known practical experimenter.

These and other features, including the regular columns of Readers' Letters, replies to Queries, and Club News, will be found in next week's issue.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Band Finishing Machine

In the article on a band finishing machine by "Finsbury" in the issue of THE MODEL ENGINEER *dated December 3rd, 1953, it was stated that ready-made machines of a somewhat similar type can be obtained in Euston Road, London, N.W. I have made a search in this district and have been unable to find a machine of this type. Can you please advise me where it can be obtained, also the name of the makers?*

H.W.H. (Warwick).

The shop in which the machines referred to were seen was that of Messrs. George Wailes & Co. Ltd., 382-8, Euston Road, London, N.W.1 and we understand that they still market these machines, though none are at the moment in stock. Accessories for the machine include endless abrasive bands 46-in. in circumference × 1½ in. wide. The makers of the machines are Messrs. Heller & Sons (Engineers) Ltd., rear of 51, Turnpike Lane, Hornsey, London, N.8.

"Atom V" 30 c.c. Engine

I am building the "Atom V" 30 c.c. petrol engine from castings supplied by Craftsmanship Models Ltd., and would be very glad if you would answer the following:

(1) *Are there any detail drawings of the oil pump? If not I should be glad of any information you can give me.*

(2) *What is the normal direction of rotation for this engine?*

(3) *What is the direction of rotation of the "Atomag Minor" H.T. magneto?*

F.H.T. (Birmingham, 15).

(1) No separate details are published of the oil pump, but they can be found in our handbook *Model Petrol Engines*, price 8s. 6d. It may be observed that the fitting of the oil pump is not an absolute necessity on this engine, as it will run perfectly well on the usual petrol-oil system of lubrication, as almost universally employed on small 2-stroke engines, but the oil pump does enable adequate lubrication to be obtained at all loads and speeds without danger of oiling up plugs or producing a smoky exhaust.

(2) The engine is intended to run anticlockwise at the fly-wheel end, but it could be converted to run in the clockwise direction by reversing the timing of the rotary admission-valve.

(3) The Atomag Minor H.T. magneto will run equally well in either direction, depending on the timing of the contact-breaker relative to the position of the magnet.

Distortion of Castings

I am making up the Turpin dividing head from castings obtained from an "M.E." advertiser, but have had trouble with them owing to distortion. The castings, after boring, close up when they are cut through to form the split clamp. Is there any means of curing this or avoiding it in future? I have found also that the castings have distorted in other places, so that nearly all surfaces have had to be corrected some months after initial machining. I understand that this is not unusual, and must be allowed for. Apart from this, the machining has been satisfactory, and I hope to be able to make a really good job of the attachment.

P.C.B.A. (Chelmsford).

The trouble you describe is rather unusual, but is presumably caused by internal strains which are locked up in the metal in the cooling of the casting.

We are of the opinion that a remedy could be found by heating the castings all over to a dull red heat before machining, and allowing them to cool as slowly as possible in ashes or lime to normalise these stresses. In the machining of cast-iron parts, it is very desirable to rough machine the surfaces first, and allow them to "season" for a time so that the stresses can become relieved before final finishing is done. To some extent the heat treatment mentioned will serve the same purpose, but there are many instances in the machining of precision parts where the tendency to distortion is found extremely difficult to eliminate completely.

Interference from A.C. Motor

I have a ¼ h.p. capacitor-start motor driving a ⅜-in. drilling machine. When the machine is running light, there is no radio interference, but when even the slightest load is applied, interference is caused in neighbouring receiving circuits. Can you please advise me how to correct this?

K.K. (Greenwich).

It would appear that the trouble you are experiencing is in the starting switch; it may also indicate that the speed of the motor slows sufficiently to allow this switch to come into action. The general drive should be checked to make sure there is no undue friction anywhere, as the fault could be due to an overload. Interference with this class of motor can only take place by the opening and closing of the starting switch.

Lathe Headstock

I have constructed a temporary lathe, using a wooden headstock, and I eventually hope to replace it with a metal one. My difficulty is how to build up the headstock. Should it be made from plates? If so, how are they laid out and fixed together? The lathe will be of 5-in. centres height.

F.E.W. (Newbury).

We generally recommend wherever possible that castings should be used for work of this nature, in preference to a built-up structure, as the latter is, generally speaking, much more difficult, unless one has access to welding and cutting equipment for dealing with fairly heavy steel plates.

We suggest that a wooden pattern could be fairly easily made for a headstock casting, and the casting, when completed, can be either machined or hand fitted, to make good contact with the bed, and the bearings can be bored in position by methods which have been described on several occasions in THE MODEL ENGINEER; that is, assuming that no other special facilities in the way of fairly large boring equipment are available.

Even in cases where the headstock is built up by welding or other methods, it is usually desirable to bore, or at least finish the headstock bearings in position, or in some similar way to ensure exact parallelism both ways with the bed.

MORE ABOUT TIPPED TOOLS

By "Tool-maker"

AFTER reading the article by "Duplex" about "Tungsten-carbide Tipped Tools" a short while ago, I realised that my experiences with them may be of some help to those interested in the subject.

I would like to emphasise their unlimited value in the small workshop, where in my opinion at least, production methods should be applied where possible. Nothing, I think, is more irksome than having to turn cast-iron at slow speeds, especially when dealing with some of the castings which have fallen to my lot at various times. Unfortunately, the initial outlay of these tools is somewhat heavy, but if, once they have been procured, care is taken in using them, they will repay their owner with much good service.

Dealing extensively with a wide range of materials in production engineering requires a comprehensive range of tips and tool forms for various operations. Tips as shown in Fig. 1 are supplied by manufacturers in a variety of shapes to suit these various tool forms. This ultimately saves a considerable amount of waste in grinding, and allows a substantial margin of adaptability. It is essential, of course, that the correct grade of tip for the material being dealt with, is used. Manufacturers, therefore, itemise as fully as possible the uses to which any particular grade of tip can be put. This, however, is not a complete guide, but is useful for our purposes, as we of the model engineering fraternity deal with quite a loosely tabulated collection of metals.

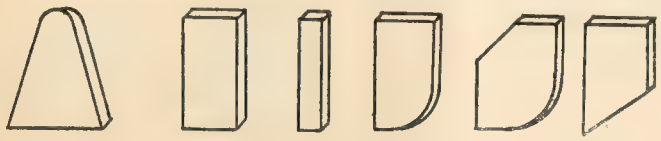


Fig. 1. A selection of tips

Grade	Make	Suggested Use
X8	WIMET	For medium speeds. For roughing and finishing and heavy duty machining of steels.
S58	WIMET	For low speeds on steels and heavy impact cutting at medium speeds.
15A	PROLITE	General purpose, cast-iron and non-ferrous metals.
21A	PROLITE	Chilled-iron and generally machine abrasives free from shock; e.g., light alloys, plastics.
3R	PROLITE	Planing and shaping tools and working under rough conditions.
8K	PROLITE	Nickel chrome and other high tensile steels.
2W	PROLITE	For heavy cuts on steel, including heavy cuts at slower speeds.

Failure of Tools

Tools are, however, still expendable, even if the correct type are used. But premature breakdown of the cutting edge is usually recognisable by one or any combination

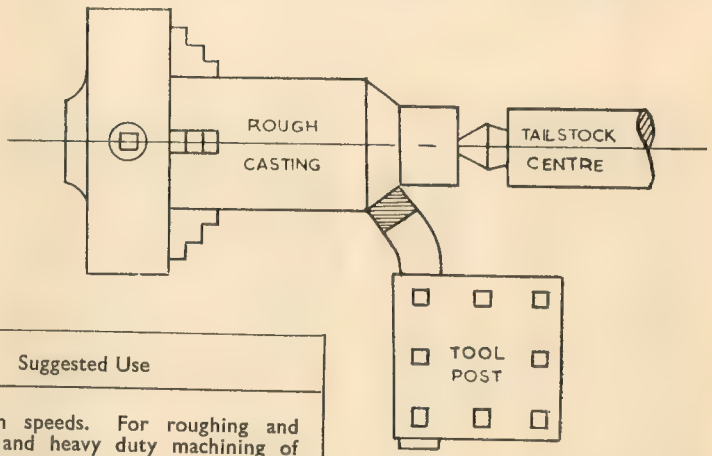


Fig. 2. Presenting the tool to the work

of three conditions. They are, fracture of the cutting edge, unusual wear below the cutting edge, and cratering on the face of the tool. These conditions are quite easily rectified in the majority of cases.

Fracturing of the cutting edge is caused by jerky movements of the tool, or vibration in the work-piece, as for example, when turning off a hexagon. Smooth cutting, adequately powered, or the attainment of a flywheel effect must be achieved, and very often a reduction in feed will do this.

Unusual wear below the cutting edge is often caused by too high a cutting speed, or more usually

(*Continued on page* 630)

A Tool Tray for the Lathe

By "Duplex"

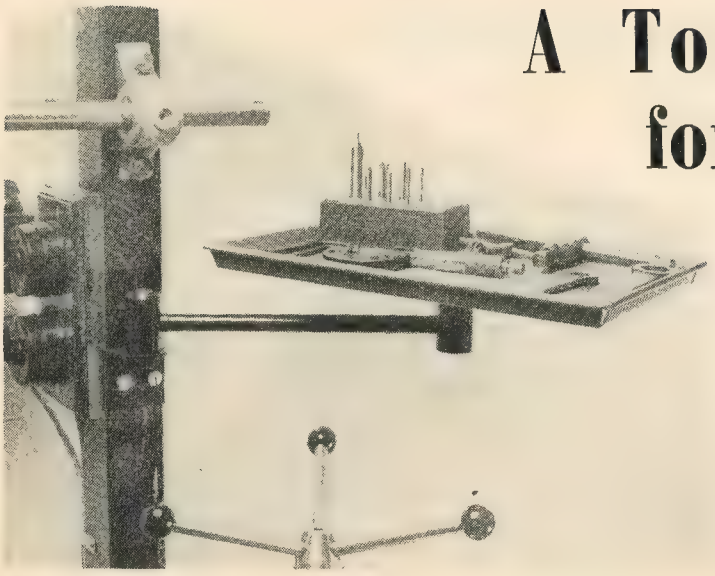


Fig. 1. *The tool tray attached to the upright of the lathe overhead*

THOSE who value their micrometers and other fine tools will hesitate to put them down amongst the swarf in the lathe tray and, if the lathe has a stand mounting, there may be no other place conveniently near at hand for depositing measuring instruments and small work-pieces in course of construction.

Where the lathe has been fitted with an overhead drive of the pattern described in a previous article, one of the uprights will provide a suitable point of attachment for a serviceable tool tray.

As shown in Fig. 1, a swinging tool-tray has been fitted to the upright nearest to the lathe tailstock, and the details of the attachment can be seen in Fig. 2.

The Mounting Bracket

To serve as a mounting, the angle-bracket illustrated in Fig. 3 is secured to the upright by two $\frac{1}{4}$ in. screws or bolts, and a $\frac{1}{2}$ in. diameter vertical pivot-pin is nutted to the horizontal limb of the bracket. The swing-arm shown in Fig. 4 is best built up by brazing two short lengths of 1 in. diameter steel rod to the central portion. The latter part consists of a length of $\frac{1}{2}$ in. diameter rod, shouldered down in the middle in order to give a more finished appearance; but a length of steel tubing will serve equally well. At its outer end, the swing-arm carries the plate, Fig. 5, for mounting the tool tray; the part shown in the drawing is fully robust for this purpose, but it was utilised, as it happened to be found in the scrap box and required very little machining. The pivot pin secured to the plate is made free to turn in the end of the arm, so that the table can be moved into a convenient working position.

The shallow, sheet-metal tray, measuring 12 in. × 8 in., was obtained from a popular multiple store, and was found to be just the right size for the present purpose. As shown in the drawing, the threaded holes in the plate for the four attachment-screws are deeply countersunk; by this means, the countersunk screws, when tightened, will force the metal of the tray into these depressions and the screw heads will lie flush.

Finishing and Enamelling

To finish the attachment, the bracket and the swing-arm were stove-enamelled black, and the tray and its mounting plate were similarly treated with grey stoving enamel. The base of the tray is best covered by a piece of rubber flooring material in order to protect the tools from damage.

Where the lathe is mounted on the bench, the tool tray can readily be incorporated with the lathe light, illustrated in Fig. 7, which was described in an article dated March 26th, 1953.

The method of attachment of the tubular upright to the Drummond lathe is by means of the bracket illustrated in Fig. 8; this part clamps

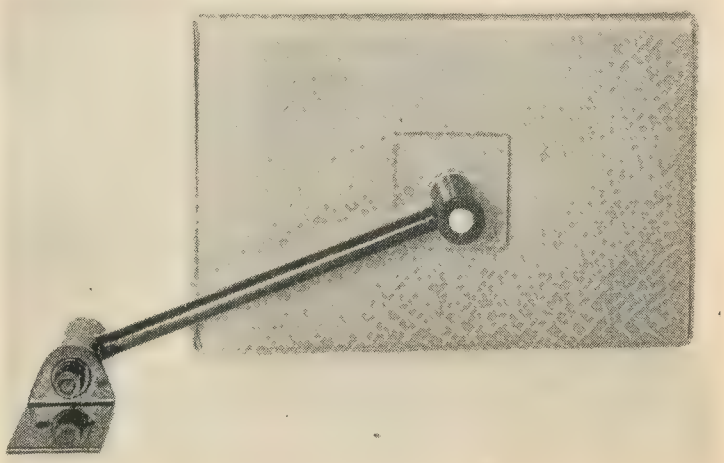


Fig. 2. *The tray and its mounting seen from below*

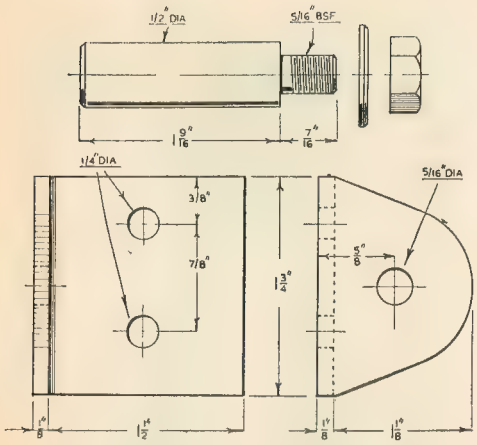


Fig. 3. The angle-bracket and arm pivot

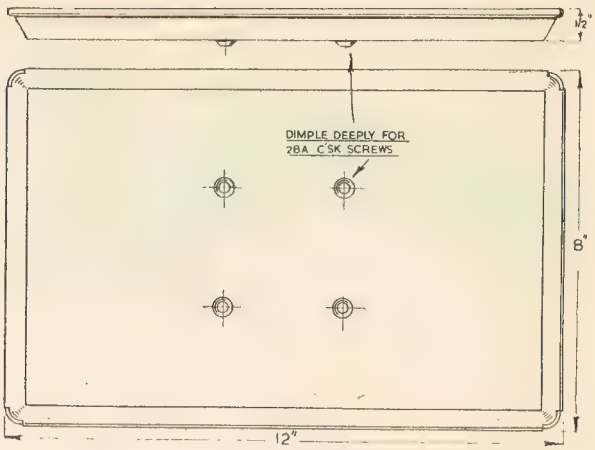


Fig. 6. The tool tray

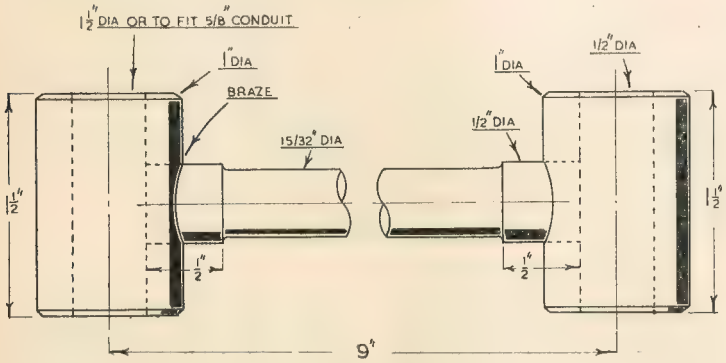


Fig. 4. The swing-arm

to the underside of the web of the bed casting at the back of the lathe. For the M.L.7 lathe, the upright is carried in the A-bracket shown in Fig. 9, which is bolted to the machined surface at the rear of the bed for mounting the taper-turning attachment. The swing-arm and tray are of the same construction as in the previous example, but the T-piece is here bored to a working-fit on the tubular upright.

As shown in Fig. 7, the height of the tray can be adjusted by means of a sliding collar, secured to the upright with an Allen grub-screw.

Although the tray is large enough to hold a selection of tools, and also

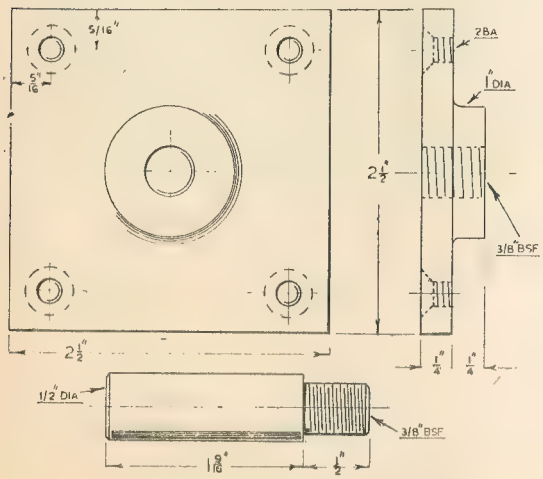


Fig. 5. The plate and pivot of the table mounting

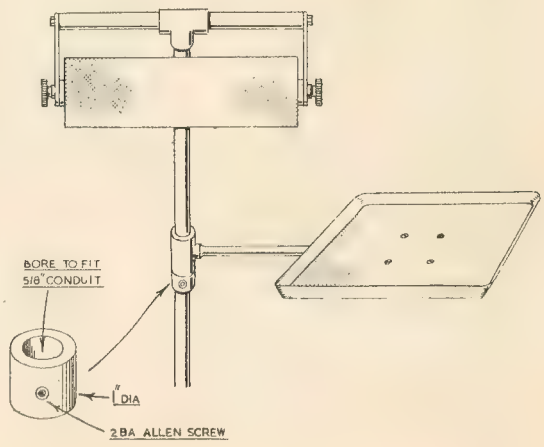
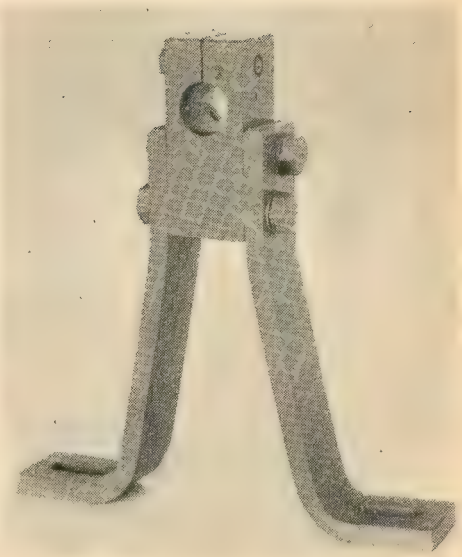


Fig. 7. The lathe light with tool tray attached

Fig. 8. Bracket for attaching the lamp standard to the Drummond lathe



Right: Fig. 9. The A-bracket for use with the Myford M.L.7 lathe

to serve as a receptacle for small work-pieces, a second tray, mounted on an independent swing-arm, can easily be added. In actual practice, much moving about and repeated visits to the tool cupboard will be saved if many of the small lathe tools and fittings are mounted in wooden stands and kept near at hand in the tray. These may include; a set of centre-drills, the drill chuck and key, and the lathe centres, as well as small boring tools and other special tools, and keys that are required from time to time.

MORE ABOUT TIPPED TOOLS

(*Continued from page 627*)

by insufficient feed. It can also be caused by vibration of the work or machine, due to end-play in the headstock bearings, or backlash in the feed. An excessive top rake on the tool gives the same effect.

Cratering is caused by an excessive cutting speed. Manufacturers of tips, however, recommend speeds and feeds for each of their products, and these are, as might be expected, the most applicable.

Approach Angles

Where scale is encountered, as in castings or forgings, abrasion is present, and it is necessary to use a tool with as long a cutting edge as possible, without assisting a departure from rigidity. This spreads the load and reduces chip pressure. In order to do this, the tool must be presented to the work at an angle, as in Fig. 2. This is called the approach angle, which may be any angle up to 45 deg., depending, of course, on the size of cut possible.

Chip-breakers

A very useful dodge when cutting steel is to grind what is known as a chip-breaker in the tip. As its name implies, its purpose is to break up the cuttings and so prevent them building up around the tool or chuck. It is, therefore, particularly useful when boring. The chip-breaker is simply a little step ground on the face of the tool at the same top rake, thus forming a ridge which breaks up the cuttings as they come off the tool. The depth and height of the step should vary with the depth of cut, but for average work a step approximately 3/32 in. deep and 1/64 in. high should suffice, (Fig. 3).

The grinding is usually carried out in a movable vice or clamp and ground on the periphery of a diamond wheel. This is beyond the means of the average model engineer, but it can be done by hand on the finishing wheel with a little practice. First, it is essential that the wheel is trimmed perfectly smooth and true, as any vibration will fracture the edge being ground. Next, the front of the tool is placed on the grinding rest and the face is presented to the periphery of the grinding wheel, the tool then being rocked backwards and forwards to cut the step.

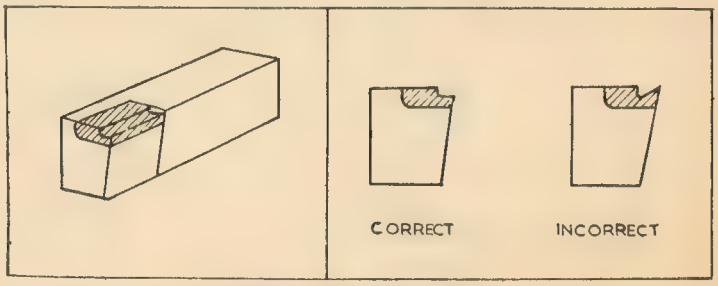


Fig. 3. The chip-breaker

WITH THE CLUBS

The Society of Model and Experimental Engineers

By the courtesy of the Eltham Club, we have been invited to spend the day on the track at Elliot's Sports Ground, at Eltham, on Sunday, June 6th, from 10.30 a.m. onwards. All will be welcome. This will afford a good opportunity for novice drivers to receive instruction at the hands of our experts. The track is some 400 ft. long and gives locomotive owners a chance to show the paces of their engines. The sports ground is in Avery Hill Road, about a quarter mile from New Eltham Station, going north-west. Visitors will be welcome.

Secretary: E. C. YALDEN, M.C., 31, Longdon Wood, Keston, Kent.

The Wakefield S.M.E.

The following meetings will be held at 7.30 p.m. at the R.A.F.A. Club Headquarters, Old Black Swan, off Silver Street, Wakefield:

Wednesday, June 9th, 1954.—"The Principles of Railway Signalling," by Mr. D. O. Whitehead. This promises to be a most interesting talk, which should give information that many people require.

Wednesday, June 23rd, 1954.—Ordinary meeting. Club business night. Arrangements are to be made for a number of track meetings. The position regarding locomotives is now, fortunately, satisfactory, and more are "growing."

Steady progress has been made on the club workshop at the headquarters. It has now been cleaned out, re-painted, and equipped with three sturdy benches!

Hon. Secretary: J. S. JACKSON, Marlborough House, Marlborough Street, Headlands, Ossett, Yorks.

The Bristol Society of Model & Experimental Engineers

The Canford Park Miniature Railway is operated by the above society.

The track provides for 2½ in., 3½ in.-5 in. locomotives. Length of track, 440 ft., 12 laps equal 1 mile.

At the end of each season the profits arising from the operation of the track are shared equally between the society and the Corporation of Bristol.

The operating dates are as follows:—

June 5th-7th (Whitsun) and 26th.

July 10th-17th and 31st.

August 2nd (Bank Holiday), 14th and 28th.

September 11th and 25th. Open from 3 p.m. to 7 p.m. Weather and circumstances permitting.

The society hold their meetings at the Folk House, College Green, Bristol.

Hon. Secretary: W. E. ROUND, 14, Britannia Road, Kingswood, Bristol.

The Model Power Boat Association

There are two M.P.B.A. regattas to be held during June.

On Saturday, June 12th, a regatta for free-running boats will be organised by the St. Albans S.M.E., at Verulamium, and on the following day the M.P.B.A. National Speed Regatta will be held, also at Verulamium.

Saturday, 12th. Usual straight events, commencing 2 p.m.

Sunday, 13th. National Speed Regatta. Events:—

1.—"C" restricted race for Wembley Trophy.

2.—Class "C" race for Wico-Pacy Cup.

3.—Class "B" race for Min. Speed Championship.

4.—Class "A" race for the International Trophy.

5.—Rolls-Royce Trophy for fastest speed of day.

Different classes will all take first runs in above order—then second runs.

Entries on the day, but competitors are asked to arrive by 11.30 a.m. for a prompt start at 12 noon.

June 20th.—Radio Control Regatta, at Victoria Park, London, E.

Programme:—10.30 a.m. Tuning up period—times allotted on arrival. 12.30 p.m. —Set course event, one attempt. per competitor. 3 p.m.—Steering contest, three runs at target. 5 p.m.—Prize giving.

Entries must be made in advance for this regatta. Entries limited to one per member and should be sent to the Hon. Secretary not later than June 17th.

Entrants are reminded that after June 1st a G.P.O. licence will be necessary and it is a condition of entry that ALL COMPETITORS SHALL BE DULY LICENSED AND COMPLY WITH THE CONDITIONS THEREOF.

Hon. Secretary: J. H. BENSON, 25, St. Johns Road, Sidcup, Kent. Tel.: Footscray 7248.

Eltham & District Locomotive Society

The next meeting will take place at the Beehive Hotel, Eltham, on Thursday, June 3rd, which will be a general discussion and question night. Members are asked to put their problems in locomotive construction or workshop practice to the meeting, and those that consider they can solve them or answer them on the blackboard, are very earnestly asked to come forward and make this an interesting evening.

Visitors are always cordially welcomed at the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, S.E.6.

Durham Model Engineering Society

The above Society still meets every Friday at 7.30 p.m. in the Vane Tempest Hall, Gilesgate, Durham. Prospective members and visitors are most welcome. Please note Secretary's new address.

Hon. Secretary: J. H. ROUTLEDGE, 13, Cathedral View, Newbottle, Houghton-le-Spring, Co. Durham.

Malden & District Society of Model Engineers

The above Society will be holding the usual Whitsun Fete, on Sunday June 6th, (Whit Sunday) at Claygate Lane, Thames Ditton. It will be seen that the arrangements are altered, and, instead of a three-day fete as in previous years, it will only be held on the one day. Admission to the Fete is free, also car park, and refreshments will be available.

Claygate Lane is opposite the Milk Marketing Board on the Portsmouth Road between Kingston and Esher, and is within easy bus journeys from Kingston and other places.

The Society extends a welcome to its friends from other clubs; a cinema and shelter is available should the weather be showery.

Hon. Secretary: G. C. SMITH, 101, Tudor Drive, Kingston-on-Thames.

International Radio Controlled Models Society

The Annual International Contests for Radio Controlled Models will be held in Birmingham, England, on July 10th and 11th, 1954.

The contests for radio controlled model boats will be held on Saturday, July 10th, and contests for radio controlled model aircraft on Sunday, July 11th. The aircraft sections of these contests, comprising a contest for power-driven aircraft and a contest for gliders, are held in accordance with the F.A.I. Regulations for International Contests.

It is hoped that a large number of competitors, both from Great Britain and from overseas, will take part in these contests.

Hon. Contest Publicity Secretary: H. CROUCHER, 27, St. Johns Road, Sparkhill, Birmingham 11, England.

THE MODEL ENGINEER DIARY

June 5th and 7th.—Salisbury and District Model Engineer Society,—Exhibition at Market House, Salisbury.

June 5th.—Welling & District Model Engineering Society. Regatta for free running boats only, at Belvedere Recreation Ground.

June 7th.—Bournville M.Y. & P.B.C. Regatta at the Valley Pool, Bournville Lane, Birmingham. Commencing at 11.30 a.m.

June 12th.—St. Albans & District M.E.S. Invitation regatta. Free running boats only, at Verulamium, St. Albans, Herts.

June 13th.—Model Power Boat Association. National Speed Regatta at Verulamium, St. Albans, Herts.

June 14th to June 26th, 1954 inclusive. —The Plymouth and District Society of Model and Experimental Engineers. Exhibition at Pitt's Memorial Hall, Gibbon Street, Plymouth.

June 26th and 27th.—Birmingham Society of Model Engineers. National Loco Rally at Campbell Green.

July 3rd.—Vickers-Armstrongs Ltd. (Weybridge) Model Club. Annual exhibition, at V.A.B. Ltd., Sports Ground, Kings Head Lane, Byfleet, Surrey.

July 10th and 11th.—International Radio Controlled Models Society. Annual Contests for radio controlled models, to be held in Birmingham.—Model Boats on July 10th, and Model Aircraft of July 11th.

August 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 27th and 28th. The Model Engineer Exhibition, at the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9 p.m.

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Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

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Denbigh 5-Speed motorised bench drill, No. 1 M.T. 3-phase, £15.—GRIFFITHS, Summerhill, Winsford, Cheshire.

3" B.G.S.C. Lathe, 3" chuck change wheels, £12, or near, buyer collets.—ATKINSON, 117, Bostall Lane, Abbey Wood, S.E.2.

Sale, Myford "Super Seven" standard equipment and Burnerd 4" s.c. chuck, all brand new, £65. 4" R.B. Drummond lathe, 4" s.c. chuck in excellent condition, £15; two precision compound slides, suitable for 3½"-5" lathes, £3 10s. each; one top slide with graduated base and 4-way tool post, suitable for 3½"-4½" lathe, £3 10s.; 0-1 vernier micrometer, carbon tipped, £3 10s.; 2-12 inside micrometer, £3, both the above are brand new, would take power bench shaper, O.E. grinder in part exchange for any of the above.—MR. NASH, 8, Spital Lane, Pitsmoor, Sheffield, 3.

3" Portass Screwcutting 4" self-centring chuck, £12. Hand shaper, automatic traverse. cast standard, £15. Exchange ½ h.p. 230 V. motor.—J. HAMMOND "Rosedale," Badsworth Kennels, Pontefract.

Zyto 3" B.G.S.C. Treadle Lathe, s/c chuck, drill chuck, f/plate, change wheels, c/shaft, excellent condition, £14 10s.—W. MOLDON, 35, Ealing Village, London, W.5.

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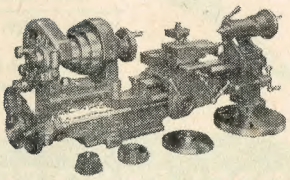

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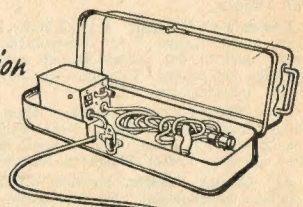

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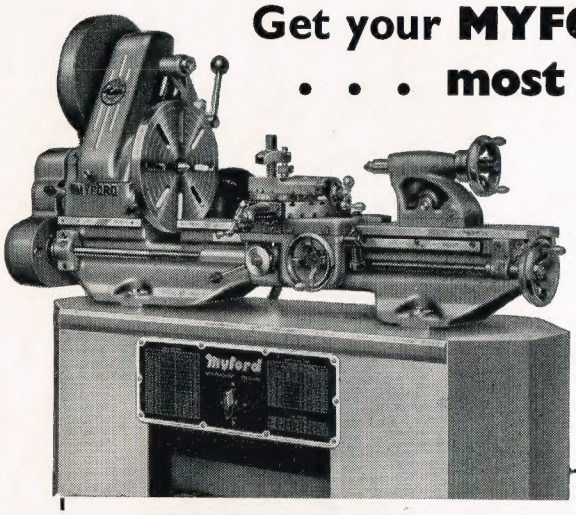

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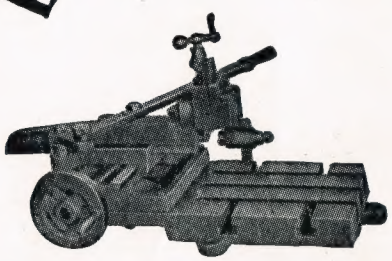

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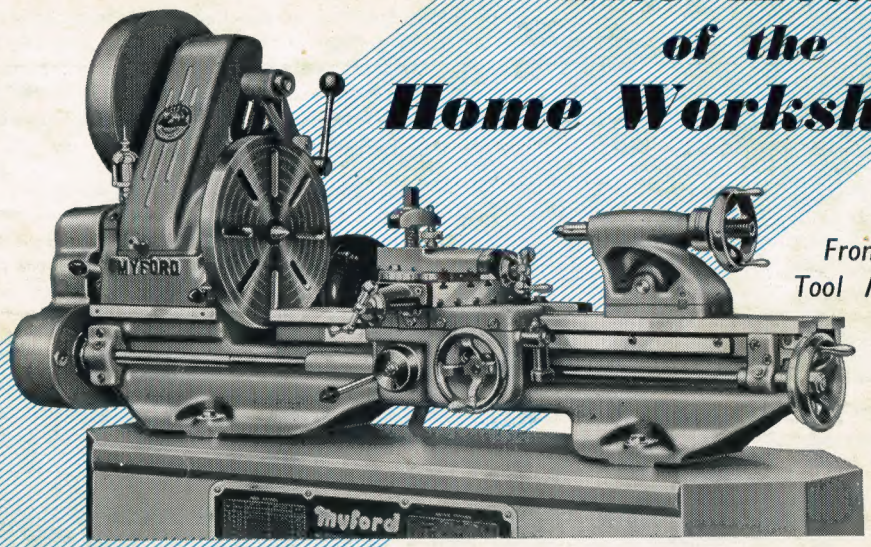

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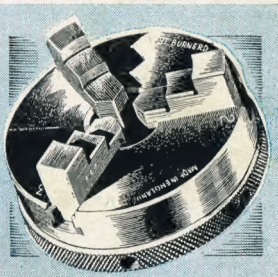

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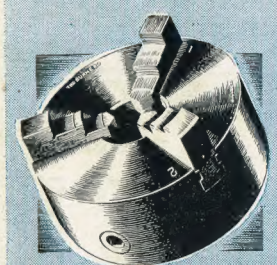

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